THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

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THE WAR AND INDUSTRY.

As the days pass by, and we as a nation become more silently resigned to the altered state of life that war has brought, the industrial world is showing that it fully recognises that it can best serve its country's interests at this time of crisis by keeping the wheels of industry going at full speed. Our commercial and industrial leaders are bringing their expert knowledge and experience to bear upon the situation, and by sane and sober measures are doing much to assist the Government and the banking authorities in their efforts to restore confidence, removing the effects of dislocation, and bringing the trade of the kingdom as nearly as possible back to the normal.

The inestimable service given by our Navy in these early days of the conflict, making secure for our own and others' shipping the great ocean trade routes to many parts of the world, will long live in the memory. We owe it to our Navy that credit and confidence are being speedily re-established, that the peoples' anxiety regarding food supplies has been removed, that the way is open for our industrial production to continue, and, as far as capital, labour and material will allow, to proceed at an accelerated pace handling business which under other conditions would have been executed from across the North Sea.

Timely action has been taken by the British Electrical and Allied Manufacturers' Association with a view to preventing the holding up of contracts. In our "Correspondence" columns to-day we print a copy of a letter which that Association has addressed to the principal railway companies, municipal corporations, and other large purchasers of electrical plant and apparatus in Great Britain, showing how serious may be the effect for the electrical industrial workers if advantage be taken of clauses in their contracts to suspend and delay work on account of the war. We hope that this and other appeals to the same effect will not fall upon deaf ears. Such purchasers as these ought to be better able than some others to abide by their contracts, and they should, and we believe will, see how responsible is the position in which they are placed, and how imperatively it is their duty to do their utmost to keep the hands of our workers fully occupied. We sincerely trust that those who have already felt it desirable to hold up electrical contracts will speedily find it possible to release them so that work on them may proceed.

The Government appeal to the Colonies, not only to take delivery of all orders placed, but to increase orders as far as possible for future requirements, with a view to helping our industrial population, has been well received and loyally responded to. Surely public authorities at home will not be less ready to assist! We would ourselves appeal to our readers in the far-off Colonies and foreign parts to expedite the placing of engineering and electrical contracts with English manufacturers.

While there are very clear evidences of a rapid recovery from the dislocation of industry, it seems to be necessary to again strongly urge everybody engaged in the electrical in-

dustry to act with the full spirit of patriotism and with sanity, and by their doings show their confidence in the present position. Confidence begets confidence. We trust that there will be nobody taking unfair advantage of the moratorium—everybody who can pay should do so without delay.

A meeting of editors of trade journals representing many branches of British industry was held in the City the other day, at which great faith in the present commercial position was expressed, but patience, confidence and reasonable sacrifice were deemed essential if we were to take full advantage of the present very bright prospects. In the recommendations arrived at by this meeting the public were urged to pay prompt cash for their present requirements: retailers were appealed to not to take unfair advantage of the moratorium; manufacturers were asked to keep up their production; and banks were desired to afford all possible support to both wholesaler and retailer.

Much attention is being given to the effect of the war upon the course of international trade, and authorities in England and America are fully alive to the great possibilities of the situation, both immediate and future. In our last issue we gave information which should be of great service to those who seek to supply the wants of purchasers whose goods are now shut up in Germany. This week we give a table showing the electrical exports of Germany to different parts of the globe during the past half-year. This will convey a useful idea as to the character, volume and destination of German electrical exports in normal times.

The total imports of all kinds from Germany into the British Empire for the year 1912 amounted to £95,500,000, of which £71,200,000 came to the United Kingdom, while India and Australia took seven millions apiece, and the remainder went to other Colonies and dependencies. As a writer in one of daily papers remarks: "These are very striking figures, and the longer the war lasts, and the longer Germany is incapacitated, the greater will be the opportunity of the British trader in the Colonial export market." German trade so won is likely to be retained for a very considerable time. We hope, therefore, that British electrical firms will leave no stone unturned to secure a large share of the electrical exports that are included in this huge total. And as we have already pointed out, they will have seriously to consider how they can provide themselves with the various electrical lines for which they have hitherto depended upon Germany. These are considerations which will occupy our minds for some time to come, but in a number of cases we must not delay action. The sooner we are prepared the better.

We conclude our present observations on the situation by approvingly quoting a sentence from a leader in one of the financial dailies:—"If everyone works hard to restore normal conditions, and fashions his conduct accordingly, the normal conditions will soon return."

The Copper Position.

The outburst of the European War has put a very different complexion upon the Metal Markets, and not the least upon copper. The closing of the London Metal Exchange has necessarily involved the complete stoppage of business of an official character, and all official quotations have, therefore, been abandoned, but there has been a little private trading in standard copper, mostly for the purpose of squaring up the books of brokers and dealers whose accounts have been thrown into a state of chaos by the declarations of war voiding the contracts of King's enemies, and also in many cases rendering it impossible to get into touch with clients in France, Belgium and Russia. Never has the position been more difficult than it has been this month, and it will take some considerable time for things to regain anything like a normal appearance. There have not been any statistics issued since the middle of July, and as far as Europe is concerned, there cannot be any fresh issue until peace is declared. Hence on this side of the Atlantic the statistical position must remain an entire puzzle for an indefinite period. To add to the complexities of the situation, too, the American Copper Producers' Association have decided not to make any further issue of returns until further notice, in view of the conditions now existing in the markets of the world. This effectually precludes any information as to the statistical position in North America leaking out. The entire market, as will thus be seen, is in a complete fog. All that is positively known is that there is a wholesale shutdown in production in progress in the United States, and it is estimated by competent authorities, that to-day output there is fully 50 per cent. below that of a month ago, while an even greater falling off is possible. Some of the leading plants, such as the Great Falls smelter of the Anaconda concern, has been closed down entirely, while a restriction of production to the extent of 50 per cent. is common. There are mines which are preparing to scale down to an even greater extent, and there cannot be the least doubt of the rigorous resolve of producers to accommodate output as closely as may be to the altered conditions brought about by the war. Under the circumstances it cannot be expected that there can be much business about in refined copper. A certain amount of buying has been done, but it has been confined almost wholly to the ammunition makers, whose energies are being taxed severely by Government orders, and who in consequence have been forced to enter the market and to pay what prices were asked. There is only a limited amount of copper available, and this is to a large extent ear-marked for national purposes. There has been no desire to exact large profits on this, and what business in electrolytic copper has been done for prompt and immediate delivery, has been put through at round £68 to £72 a ton. Supplies are not coming forward from the United States with any freedom. One or two of the big German liners took in good qantities of copper, but after sailing were recalled to New York by wireless owing to the risk of capture, and there they remain waiting for the war to finish. Meanwhile there can hardly be said to be an open market price for the metal, and business is restricted to the satisfaction of pressing needs.

The Miner and War.

At the outbreak of hostilities there was some fear that the miners might show the cloven hoof, and become awkward, and certainly had they blindly followed the leaders' advice there might have been trouble, as coal for our Navy is a vital necessity, and the country was rightly indignant at the refusal of the leaders to allow the men to forgo the usual holiday in order to produce coal which was urgently needed owing to the mobilisation of the fleet. We say the leaders, because we are certain the rank and file of the miners are as patriotic as any workmen in the country. This is shown not only by the large numbers of miners who are now serving with the Regular or Territorial Forces, but by the fact that all the colliery ambulance brigades have, *en masse*, volunteered for service at home or abroad—and we are convinced that had it not been for the advice of leaders with exalted views of their own importance, there never would have been any question of the South Wales pits remaining idle. They have, however, apparently seen the mistake of such a policy, and we are glad to hear that the miners in all collieries supplying coal to the Admiralty have agreed to work on Sundays if necessary, and to work one hour per day extra.

One can admire the ideals of the leaders, but one must object to the methods they adopt towards their attainment. They savour too much of the methods of the Kaiser, and we would ask them to look into their inmost hearts, and ask themselves, do they lead, or attempt to lead, for purely altruistic principles, or is it because of the old Adam that is in most of us, the lust for power? Whatever may be the collective opinion of the miners on the views of the leaders, we may rely at any rate upon the fighting spirit of the individual to see that his King and country shall not suffer, so far as he can prevent it, and in the great trial that is before us all we may be sure the miner will be in the very front ranks bravely doing his duty.

GATUN HYDROELECTRIC DEVELOPMENT FOR THE PANAMA CANAL.*

The permanent supply of electric energy for the Panama Canal is generated in the Gatun hydroelectric station, which is located at the Gatun spillway dam. The tremendous water storage in the artificial Gatun lake, fed by the Chagres River, not only carries vessels the greater part of the way across the isthmus on a level about 85 ft. above the oceans, and provides water for raising and lowering them gently through the Gatun, Pedro Miguel and Miraflores locks, but it also has afforded an excellent opportunity to generate electric current for lighting the Canal, for operating the gigantic gates and other locking machinery, and for towing ships through the locks.

Electric current will likewise be used for coal-handling plants at both ends of the Canal, for machine shops, waterworks, dry docks, and possibly in the future for hauling trains on the Panama railroad. To ensure continuity of service in case of accident, a steam-electric station at Miraflores, erected a few years ago to supply power for construction work, will be ready to take up the load when necessary.

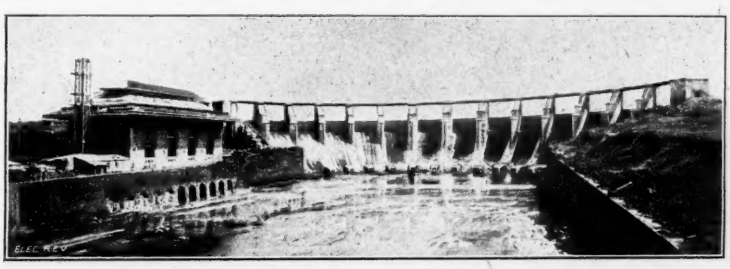


Fig. 1.—Gatun Spillway Dam, showing Fourteen Crest Gates, Ogoe Dam and Baffle Piers; Hydro-electric Station on left.

The complete equipment for the power and distribution system on the canal comprises the 7,500 K.V.A., 2,200-volt hydro-electric power plant at Gatun; the 4,500 K.V.A., 2,200-volt Curtis turbo-generator electric power plant at Miraflores for emergency; a double 44,000-volt transmission line across the Isthmus, connecting Christobal and Balboa with the two power plants; four 44,000/2,200-volt sub-stations, stepping down at Christobal and Balboa, and up or down at Gatun and Miraflores, depending on which of the two plants is supplying power; 36 2,200/240-volt transmission stations for power, traction and light at Gatun, Pedro Miguel and Miraflores locks; three 2,200/220/110-volt transformer stations for the control boards at the locks; and stations at Christobal and Balboa for the coal-handling plants, machine shops and dry docks.

The Gatun hydro-electric station has a capacity of 6,000 KW., and provision has been made to increase this to an ultimate capacity of 12,000 KW., should this amount of power be required later for the operation of the Panama railroad, the three outlet pipes in the dam having been installed along with the original pipe-lines.

The gross head available from Lake Gatun to mean tide level of the Pacific Ocean varies from a maximum of 91 ft. in the extreme flood times to a minimum of 79 ft., to which level the lake may possibly drop toward the close of the dry season. The plant is consequently designed to develop the full water output when operating under an effective head of 75 ft. For three or four months of every year there is absolutely no rainfall on the Isthmus; and during this period it is desirable to conserve the water to as great an extent as possible. Maximum efficiency was therefore demanded for the apparatus of both the water-wheel and generator manufacturers.

Water is taken from Lake Gatun through passages 12 ft. wide, fitted with wrought-iron racks 29 ft. 7 in. high, to prevent trash from entering the pipe-lines. The water is admitted into the pipe-lines through three head gates, 10 ft. 6 in. in diameter, of massive cast-iron construction, the seats where water-tightness is required being made of bronze.

Each gate is equipped with two steel stems for raising and lowering. These stems are fitted with bronze nuts working in roller thrust bearings, and the nuts are fitted with steel bevel gears arranged to be operated by a 15-H.P. motor. The gates are equipped with automatic control devices, consisting of a limit switch geared to one of the gate stems, and a float switch actuated by the water in the pipe. The action of the control is as follows, the gate being closed and the pipeline empty:—The gate motor switch is closed at the power house, starting the motor which begins opening the gate. When the gate has opened a sufficient distance to fill the pipeline in about five minutes, the limit switch opens the circuit and stops the motor.

The gate remains in this position until the pipeline is filled, and the water rises in the 36-in. diameter air vent just below the gate, when it actuates a float switch, and again closes the motor circuit, thereby causing the gate to be opened fully, when the limit switch again operates to prevent over-travel. The gate is closed by reversing the main switch at the power house, which causes the motor to operate, the limit switch again stopping the motor when the gate has reached the closed position. In case the electric power should fail, the gates can be hand-operated by two men.

Each of these gates is bolted to a pipeline 10 ft. 6 in. in diameter, with an average length of 420 ft. The pipelines are made of $\frac{3}{8}$-in. steel plates, and are covered with a layer of reinforced concrete to prevent rust. Each of the pipelines is arranged for attaching a Pitot tube testing apparatus while its unit is in service.

The principal buildings connected with the actual operation of the canal are the hydroelectric station at Gatun spillway; the gate control house at the spillway; the four sub-stations of the transmission system, and the three lock control houses. All these structures are designed along simple lines in harmony with the unbroken concrete surfaces of the adjacent engineering works.

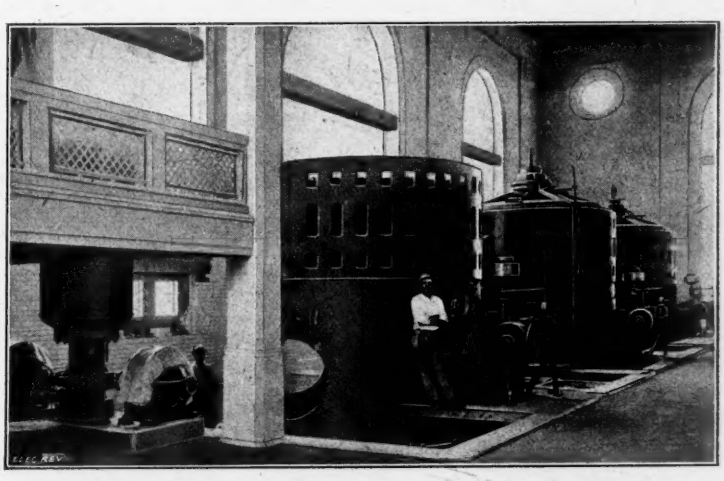


Fig. 2.—Interior of Gatun Hydro-electric Station.

The hydroelectric station measures 61 ft. by 137 ft., and has an extreme height of 74 ft.; it consists of a single room open to the roof. The turbine pit, with an area of over 2,100 sq. ft., is located 6 ft. below the level of the main floor, and is lined with white enamelled brick.

* See also Electrical Review, Vol. 74, p. 288.

Concrete stairways at either end of the building give access to the mezzanine and second galleries, which are devoted to the switchboards, oil-switch compartments, reactance coils and other electrical equipment. Two such galleries extend the entire length of the station on the north-east side.

The three 2,000-kw. main generating units in the hydro-electric station are each driven by a special 50-in. vertical single-runner Francis turbine, manufactured by the Pelton Water-Wheel Co. Each turbine has a maximum capacity of 3,600 h.p. when operating under an effective head of

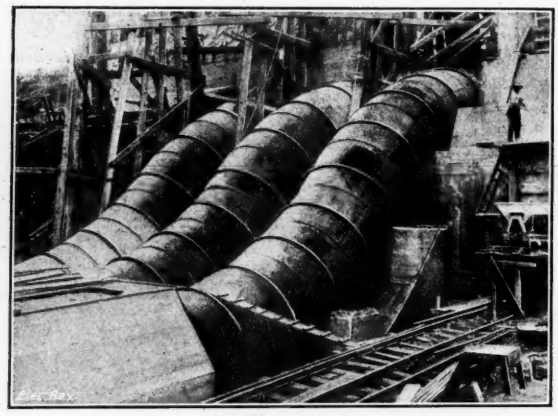


Fig. 3.—"Ogoe" Curve at Gatun Hydro-electric Station, immediately below Headgates.

75 ft., and at a normal speed of 250 r.p.m. The turbines are located at such a height that the centre of the runners is 20 ft. above tail water.

The water is discharged through steel-lined concrete draught tubes, which are 71 in. in diameter at the discharge from the runners, and increase to an elliptical section

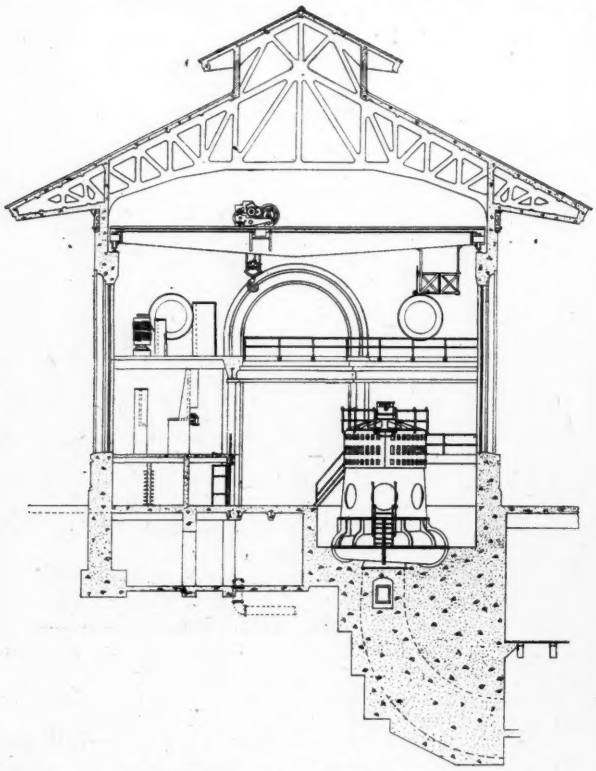


Fig. 4.—Vertical Section of Power House at Gatun.

of 9 ft. × 17 ft. at the outlets, which are horizontal, there being a 90° bend in the tubes. The linings are made of ¼-in. steel plates.

The turbines are of the spiral case type, and are fitted with heavy cast-iron distance rings which carry the generators. The weight of the revolving parts of each generator and turbine is carried on a roller thrust bearing mounted on top of the generator. The turbine is so designed that the runner exerts an upward thrust of 20,000 lb. when

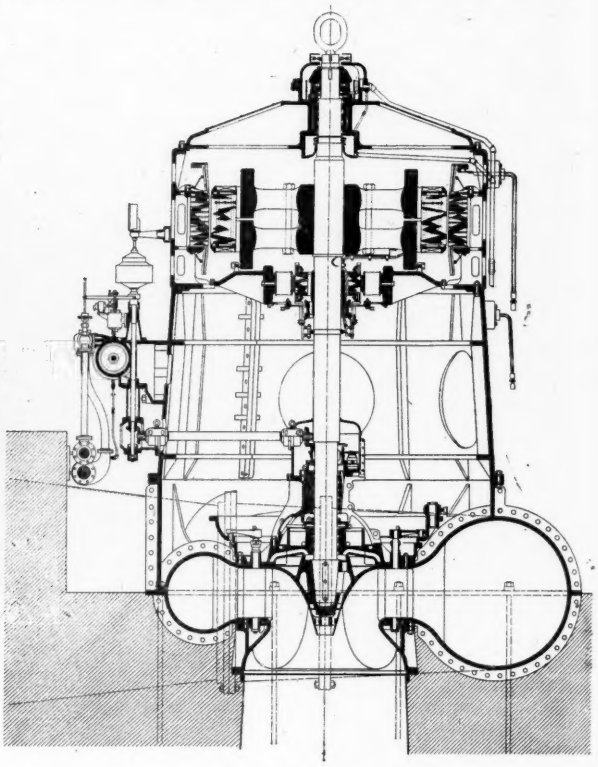


Fig. 5.—Section through Waterwheel, Generator and Exciter.

working at full capacity, thereby relieving the thrust bearing of that amount of load. Forced lubrication is provided.

The runners of the turbines are made of a special bronze and weigh approximately 7,000 lb. each. The surfaces of

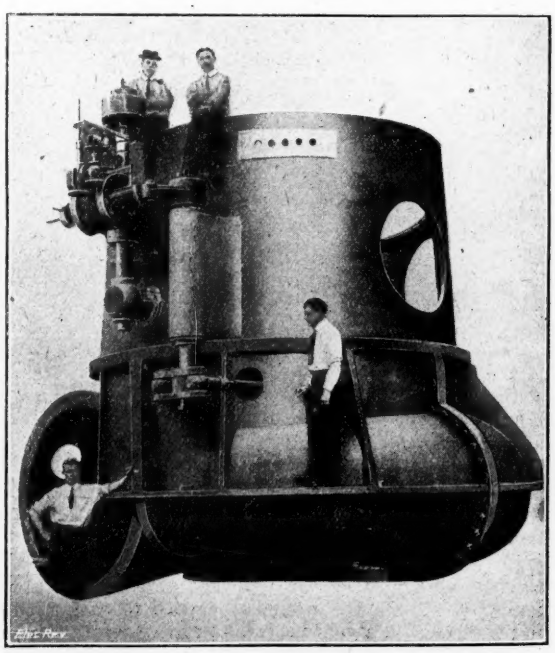


Fig. 6.—3,600-h.p. Francis Turbine for Gatun Hydro-electric Station.

the runner vanes are all hand finished, to reduce hydraulic losses.

The speed of the turbines is controlled by Pelton oil-pressure governors, driven by bevel gearing from the main

shaft. The governors are fitted with small electric motors for varying the speed of the main units for synchronising purposes, and a device is provided on each governor for varying the permanent drop in speed from no load to full load. The pressure oil for actuating the governors is supplied by two Pelton rotary pumping units, driven by 10-H.P. motors, each pump being capable of supplying the governors on all three units.

The three main generating units are of the vertical revolving-field type, each being provided with a direct-connected exciter. The generators were made by the General Electric Co., U.S.A., and are three-phase, 25-cycle, with a guaranteed continuous capacity of 2,000 KW. at 0·8 power factor, 2,200 volts, 250 R.P.M., and with an overload rating of 2,500 KW. at 0·8 power factor for two hours. The exciters are of 50-KW. capacity at 125 volts, each capable of furnishing exciting current for two generators under maximum guaranteed load. Each unit, generator and exciter, weighs approximately 65 tons.

The generators are carried on the cast-iron distance rings furnished by the Pelton Water-Wheel Co., the stationary armatures being bolted to these rings. The thrust and upper guide bearing support consists of a very rigid iron casting, bolted to the top of the stationary armature.

The thrust bearings, manufactured by the Standard Roller Bearing Co., of Philadelphia, carry the weight of the complete revolving element.

There are two guide bearings, one immediately below the thrust bearing and the other above the water-wheel. The arrangement of the complete unit is shown clearly in the cross-sectional view.

The generators, under official tests, showed an efficiency of 95·1 per cent. at 2,000 KW.; 94·3 per cent. at

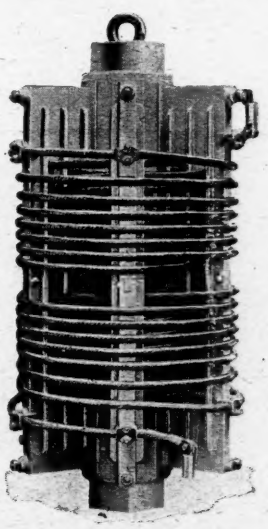


FIG. 7.—CURRENT-LIMITING REACTANCE WITH CONCRETE CORE, 25 CYCLES, 42 K.V.A., 64 VOLTS, 656 AMPERES.

1,500 KW.; and 9·25 per cent. at 1,000 KW., all at 0·8 power factor. The guaranteed temperature rises of 40° C. above room temperature of 25° C. under continuous operation at full load, and 55° C. rise after two hours' run at 25 per cent. overload, were met with an ample margin.

All of the apparatus was subjected to the most rigid and minute inspection during manufacture by representatives of the Isthmian Canal Commission. The insulation of all windings was made moisture-proof on account of the extreme climatic conditions on the Isthmus. The revolving field was given a running test at twice normal speed in the testing pit at the factory provided for this special purpose.

Current limiting reactances were provided to give 5 per cent. reactive drop at 2,500 K.V.A., 2,200 volts, three-phase, 25 cycles. While the generator windings are sufficiently rigid to stand the strain of a short circuit under full load, these reactances will reduce the shock on the windings, and will also serve to render the operation of synchronising the machines easier and safe.

In addition to the direct-connected exciters, two motor-driven exciters were supplied, each consisting of a 100-KW., 125-volt, 500-R.P.M. generator, direct-connected to a 150-H.P., 2,200-volt, 25-cycle squirrel-cage type induction motor.

On account of the great distance, the current is transmitted at a voltage of 44,000 from the power stations to both ends of the canal. The step-up transformers are, however, not located in the power plants, but in sub-stations in their vicinities; therefore, the power plants generate and distribute only 2,200-volt current. The system of connection throughout employs the double bus-bar, double-switch scheme, with provision for disconnecting any oil switch for cleaning or repairs without interrupting the circuit.

The main switchboard is of the benchboard type, with vertical rear board for relays, watt-hour meters, graphic instruments and the control battery equipment. The switchboard and all control apparatus were built by the General Electric Co. On the top of the switchboard is a second story, for the electrically-controlled generator and exciter rheostats. The first panel from the left in the benchboard controls the exciters, the next three the generators, and the remaining four the 24 feeder circuits. The system of connection is represented by dummy bus-bars of polished copper on top of

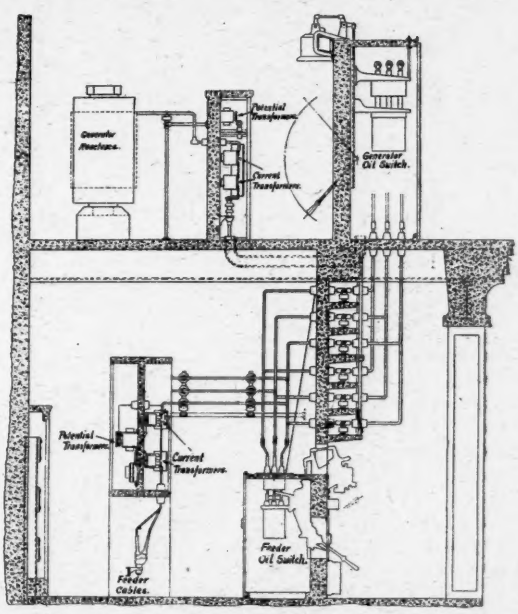


FIG. 8.—ARRANGEMENT OF SWITCHING APPARATUS IN GATUN HYDRO-ELECTRIC STATION.

the bench. The interior view of the benchboard shows the arrangement of operating bus-bars and fuses, potential buses, instrument resistances, and the channel iron risers with distributing tubes, which carry the instrument and control leads to their points of connection on the board.

A generator voltage regulator, transferable to either of the two sets of bus-bars, is installed on a separate pedestal which also carries the synchronism indicators and clock. The electrically-operated exciter switches and field switches are mounted on a separate board.

The bus-bar and switch compartments are located on two galleries. On the upper gallery are the control board near the end of the station that may be extended, the generator reactances, a compartment for generator current and potential transformers, and the generator oil switches. From the oil switches, connections are made through the floor to the bus-bars on the gallery below, on which gallery are also the feeder oil switches, and the compartment for the instrument transformers and cable bells. On the main floor just below this gallery is the cable vault with racks for the feeder cables.

All the compartments are built of concrete with flame-proof doors. The bus-bars and connections are made of solid copper rods of sufficient size to give a rigid construction even where the current is very small. After installation, the bus-bars and connections and all joints were heavily insulated with varnished cambric to make them perfectly safe.

C

The complete hydraulic equipment for this installation was designed and built by the Pelton Water-Wheel Co., and all the electrical apparatus by the General Electric Co., U.S.A. The details of design and manufacture of all this apparatus were subject to the approval of the Isthmian Canal Commission's engineers. The shipping weight of the material furnished by the Pelton Water-Wheel Co., including the auxiliary electrical apparatus purchased by them from the General Electric Co., was approximately 1,000 tons.

We are indebted for the foregoing particulars and illustrations to the courtesy of the General Electric Co., U.S.A., on whose behalf they were forwarded to us by the British Thomson-Houston Co., Ltd., of Rugby.

ELECTRICITY SUPPLIES FOR KINEMATOGRAPHS.

By W. B. S.

As showing the magnitude of the kinematograph business, it is estimated that there are over 6,000 picture houses in Great Britain, three times that number in America, and between 50,000 and 60,000 cinema shows in the world. Even remote corners of Central Africa, India and China have their picture houses. In Manchester there are 94, Glasgow has 40, Liverpool 22, and even in a small town like Selby, with 9,000 inhabitants, there are four cinema houses. It is calculated also that in Britain, with its 6,000 picture theatres, employing more than 100,000 persons, over 8 million people visit these shows every week.

It is proposed in this article to deal briefly with a few of the methods in general practice of obtaining a supply of electricity for kinematograph lanterns, and to indicate some of the arrangements adopted in theatres where the system and pressure of supply from the public mains are not suitable for running a single arc efficiently.

As the cost of electricity bears no small proportion to the total running charges of a picture house, it is interesting, from a financial point of view, to see how far the electricity bill can be reduced by the installation of efficient electrical plant. Neglecting the current required for the general illumination of the interior and exterior of the house, and the energy required for illuminated signs to attract the attention of the public, all of which will depend on local conditions and the enterprise of the promoters, it will be apparent that the greatest saving to be looked for will be in connection with the method of supply to the lantern.

For the proper striking and maintenance of an arc, it is necessary to have an available drop in pressure of about 50 volts across the carbons. The strength of current required depends on the projection (*i.e.*, the distance from lantern to screen), on the lens, the density of the films, and very often on the skill of the operator. In one case 30 amperes may be sufficient, while 60, 80, 100, or 150 amperes may be necessary to give a clear picture in other cases. Coloured films, being slightly denser, require a considerably greater current than ordinary films.

In country places where no public supply of electricity is available, gas-engine or oil-engine generating sets are installed in preference to the older form of limelight. These sets may serve the purpose of lighting the building in addition to furnishing energy for the arc.

Gas-engine sets, either direct-coupled or belt-driven, have been installed in many theatres, and the results obtained quite justify their installation. The consumption of gas per unit generated by the dynamo is 30 cb. ft., so that if gas is sold at 2s. 6d. per 1,000 cb. ft., the cost per unit generated is in the neighbourhood of one penny, neglecting lubricating oil and attendance.

With oil-engine sets the cost of running is greater, an average price per unit generated with such a set being about 2d. with petrol at 1s. 1d. per gallon. Small direct-coupled oil engine sets using petrol or paraffin may be had to suit the purpose in country villages. The travelling cinema show is catered for by several firms who have portable oil engine sets costing about £160 complete with engine, dynamo, resistance, regulator, switchboard, oil-tank, circulating water tank, &c., mounted on a four-wheeled truck suitable for hand or horse haulage. The dynamo of this set is capable of delivering a current of 50 amperes at 60 volts, but larger sets may be obtained if desired.

Where a local authority gives a general supply of electricity it will be more economical and more convenient to take energy from the supply mains. The supply pressure, however, is usually much greater than the voltage necessary for the arc, so that some means of reducing the pressure must be resorted to. Where the general supply is on the direct-current system there are two methods of obtaining the required voltage.

1. By the use of resistances, and
2. By using a motor-generator set or rotary converter.

Fig. 1 shows the connections of a series resistance with three steps giving 20, 40 or 60 amperes. Allowing 50 volts

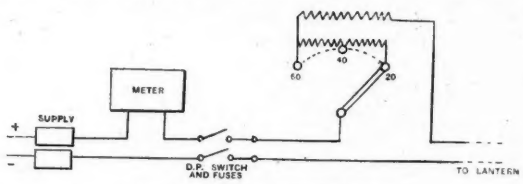


Fig. 1.—Series Resistance.

for the arc, the 60-ampere resistance coil should have an ohmic resistance of—

$$R = E/C = 200/60 = 3{\cdot}4 \text{ ohms}$$

for a 250-volt supply, and be capable of carrying this current for six hours without becoming red hot. The 40-ampere coil should safely carry this current, but as it will be used in series with the 60-ampere coil, its resistance need only be—

$$R = E/C = 200/40 = 5 - 3{\cdot}4 = 1{\cdot}6 \text{ ohm.}$$

For the 20-ampere step, a coil having a resistance of—

$$R = 200/20 = 10 - (3{\cdot}4 + 1{\cdot}6) = 5 \text{ ohms}$$

has to be added, and may be made up of much smaller gauge resistance wire than the other coils.

Fig. 2 is a diagram of connections for a parallel resistance frame with selecting switches to give from 10 to 60 amperes, in stages of 10 amperes. The ohmic resistances of the coils with this arrangement will be 7 ohms, 10 ohms and 20 ohms respectively for 30, 20 and 10-ampere steps.

The waste of electrical energy in resistances is, however, a heavy item, for, assuming a lantern to take 60 amperes at

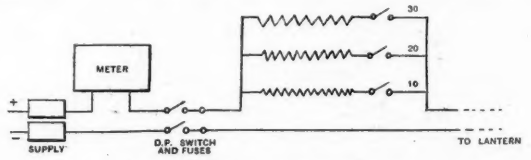


Fig. 2.—Parallel Resistance.

50 volts, from a supply pressure of 250 volts, the energy used per hour by lantern = 60 × 50/1,000 = 3 units.

The energy wasted per hour in resistance = 60 × 200/1,000 = 12 units, so that out of the total energy of 15 units per hour paid for, 80 per cent. is lost in the resistance. The efficiency of conversion is therefore only 20 per cent., and with higher supply pressures the efficiency becomes proportionately smaller.

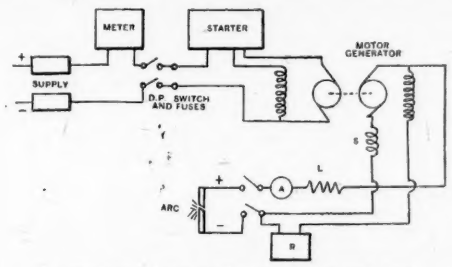
Almost every picture house supplied from public mains has one or more motor-generators installed to more efficiently convert the energy from the supply pressure to a pressure suited to the arc in the lantern. The motor, wound for any voltage, direct or alternating current, is coupled to a generator giving the required pressure. The saving effected by a motor-generator in the before-mentioned example would be as follows :—

Assuming the motor to take 19 amperes at 250 volts, while the generator delivers 60 amperes at 50 volts, the—

$$\text{Efficiency} = \frac{\text{Output}}{\text{Input}} = \frac{60 \times 50}{19 \times 250} \times \frac{100}{1} = 63 \text{ per cent.},$$

so that out of a total of $4\frac{3}{4}$ units paid for per hour, only $1\frac{3}{4}$ units are lost in conversion. At 3d. per unit the cost per hour of using resistances in the example cited would be 3s. 9d., compared with 1s. 2d. per hour with the motor-generator system. Further reduction in running costs will, of course, be effected where the supply authority allows a reduced rate of charge for motor-generator supplies.

Fig. 3 gives the connections for a motor-generator system with shunt motor, and compound-wound generator. L is the line resistance to steady the current, and R is the shunt



R, regulator; S, series winding; L, line resistance.

Fig. 3.—Motor-Generator Connections.

regulator to vary the generator voltage to give variations in current to suit the particular film being passed through the lantern. Some manufacturers of this type of plant design the generator with a reverse compound winding to give a drooping characteristic curve, as shown in curve A, fig. 4. The object of the reverse winding is to cause a fall in the pressure across the arc as the carbons are short circuited, thus obviating the use of the line resistance. It is not advisable, therefore, to install a generator with a winding such as this if the dynamo supplies a lighting load in addition to the lantern. In such cases the compound winding is designed to give an almost constant pressure at all loads, as illustrated in curve B. Should the lighting load be small in comparison with the current required for the arc, the series coils on the generator may be dispensed with altogether, and the machine arranged to run as a shunt dynamo, giving a characteristic curve, as shown in curve C, fig. 4.

To obtain a higher efficiency with motor-generator sets, most of the manufacturers of this type of plant have adopted

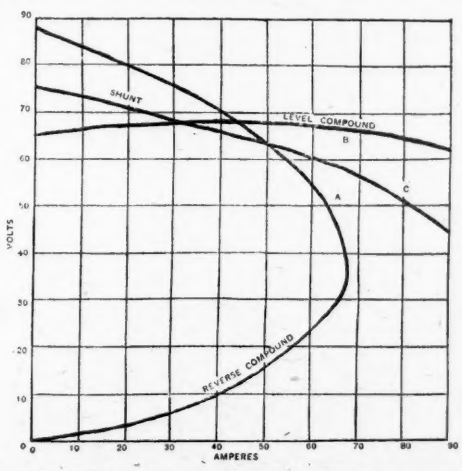


Fig. 4.—Characteristic Curves.

a system of interconnecting the motor and generator windings, and these makers claim that the sets become more automatic in operation by the use of the interconnected windings. In the "Macfarlane" auto-converter—a diagram of connections of which is shown in fig. 5—the set is made up either as two separate machines coupled together, and mounted on one bed-plate, or as two armatures on a common shaft revolving within a single long field system, there being only two outer bearings. Electrically the armature windings are in series, the fields of the motor and generator being connected in parallel across the supply voltage. The motor field is a separately-excited shunt winding, but the generator field, although also independently excited, is

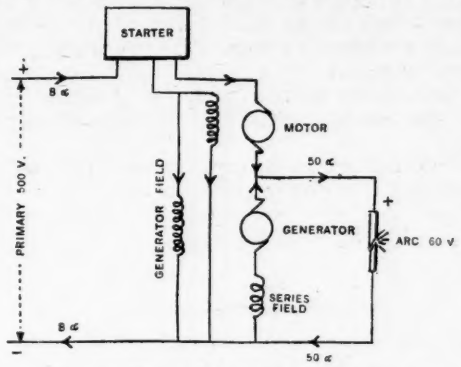


Fig. 5.—Macfarlane Auto-Converter.

opposed by a series winding carrying the dynamo current (not the arc current). The arrangement outlined allows of approximately constant current being obtained for the arc for any value of resistance in the arc circuit (fig. 6), and this is carried out by properly proportioning the values of the shunt and the opposing series windings of the dynamo field. The current flowing through both armatures supplies the current for the arc, and if the carbons in the lantern were to be short-circuited, only a current necessary to supply the no-load losses of the set will be flowing from the supply mains. At full load both armature windings are furnishing a considerable portion of the load current to the arc, but on

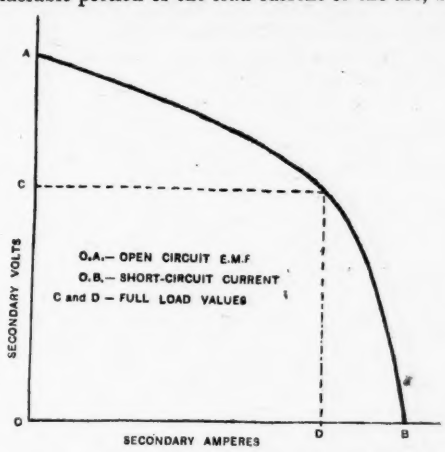


Fig. 6.—Curve of Macfarlane Converter.

very light loads the two machines are acting as motors in series. Hence, it is seen that the current in the dynamo varies from a small value at light loads to a large value on almost short-circuit conditions, and, therefore, the opposing winding on the dynamo field is connected so that it carries the dynamo current. If it is desired to have a short circuit current not greater than, say, 80 amperes, then the windings of the dynamo must be such that on short circuit the opposing series winding will wipe out entirely the effect of the permanent shunt winding, the proportion between the two differential windings being also so arranged that when the normal full load current is taken by the arc, sufficient field is induced in the generator to give the normal voltage required for the arc. The efficiency of this converter varies from 70 to 80 per cent. on full load.

(To be concluded.)

Patent Application. — Messrs. Sparking Plug Patents, Ltd., of Birmingham, are applying for leave to amend Patent No. 5,210 of 1909, granted to Bernard Hopps for "Improvements in and relating to ignition devices for internal combustion engines." See our advertisement pages to-day.

D

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Central Testing Institution.

I have read with interest the recent communications from Mr. Wordingham and from Mr. Dana Pierce, electrical engineer of the Underwriters' Laboratories of Chicago, in connection with the position of British electrical appliances in the Canadian market, and a testing institution for electrical appliances.

I would like to draw attention to one or two essentials in connection with such a proposed testing institution.

It will hardly suffice to establish an institution along the lines indicated by Mr. Wordingham, if such a testing institution is not in a position to enforce its decrees, and compel all electrical accessories manufacturers and the trade in general to install only tested and approved appliances in a proper manner.

The Underwriters (fire insurance companies) of the United States and Canada have established and maintained their own laboratories in Chicago, and all these companies co-operate in enforcing the rules and regulations of their electrical committee, who are in turn guided by the tests of electrical devices by their laboratories. We have here definite conditions requisite for the proper testing and control of electrical devices which do not appear to exist in Great Britain.

Manufacturers of electrical goods will not in all cases submit their materials for tests, nor will the trade be restrained from selling or installing any appliances which may not have been tested or approved by this central testing bureau, unless there is some definite power, either Governmental, municipal or private interest, to positively enforce their decrees. Some combination, such as the Fire Underwriters, having direct commercial gain and loss involved in, and dependent upon, the correct use of thoroughly safe electrical appliances, tested and approved by their own or some authorised bureau, would appear to be necessary.

Safe electrical appliances and their proper installation have a direct bearing on the fire risks of any building, and the U.S.A. insurance companies realising this, have established a definite set of conditions which require that only those electrical appliances which have been tested and approved by their own laboratories shall be installed, and that the installation shall be completed in accordance with their electrical committee's rules—all before any permission is given for the installation to be connected up and any insurance authorised.

If the insurance underwriters of Great Britain could co-operate in the same manner as the underwriters of the United States and Canada have done, and establish their own testing bureau, they could justify the expense involved by the increased safety in fire risks secured. It would seem that the underwriters are in the position where it would be to their interests not only to initiate, but to undertake the full establishment of, such a testing bureau and the classification and approval of all desirable electrical appliances along the lines of the Underwriters' Laboratories in Chicago, whose rules extend over Canada, and have conflicted with many English electrical appliances.

Atlantic.

August 15th, 1914.

Electrical Engineers and the War.

Referring to your editorial remarks on the above subject, I should like to remark that upwards of 40 replies had reached me from all parts of the country with offers of help before the I.E.E. had taken action.

However, within two hours of my receiving the particulars of the I.E.E. scheme I called on Mr. P. F. Rowell, and handed to him about a score of replies which had reached me. To those who were members of the Institution replies had been sent, but in a letter to me Mr. Rowell remarked :—"In regard to those who are not members, I do not feel justified in inviting them to fill in these forms, and if, therefore, you should send them any of the forms now sent to you, I should be obliged if you would request each one to give the name of a responsible person to whom reference may be made if necessary." I have acted as requested.

It is apparent to all that overlapping is detrimental to organisation work, hence I enclose an I.E.E. form in my replies to any query reaching me, feeling sure that any effort of mine will not be taken as an attempt to gain notoriety. I am satisfied to know that I first proposed the above organisation.

W. Ellerd-Styles.

Leytonstone, N.E., *August 14th*, 1814.

The following is a copy of a letter addressed to me from the War Office, and may be of interest :—

War Office, London, S.W.
August 16th, 1914.

Sir,—With reference to your letter dated the 9th inst. asking if the services of trained men drawn from all branches of the electrical engineering will be accepted, I am commanded by the Army Council to express their sincere thanks for the generous and patriotic offer.

The Army Council are, however, of opinion that all the energies of the country should at present be directed to the raising of the new army of 100,000 men, and they regret that until this has been accomplished they are unable to avail themselves of the services loyally offered.

I am, Sir, your obedient servant,
B. P. Cubitt.

There is no reason why we should not organise and prepare.

W. Ellerd-Styles.

Leytonstone, *August 18th*, 1914.

Mysterious Behaviour of a Generating Set.

Referring to Mr. Wood's experience with his 750-kw. turbo-generator—the behaviour of the machine is not quite so extraordinary as the behaviour of the attendant.

It was obvious that the connections had not changed themselves over, and therefore it was quite wrong to interfere with these.

I should think that the trouble was due to the instability of the exciter at low voltages, as would be the case if the set were designed to work in conjunction with both exciter and alternator rheostats.

If the main field rheostat was short-circuited, the alternator regulation being obtained by changing the voltage across the exciter, *i.e.*, by means of the exciter rheostat, the straight part of the exciter characteristic would be reached, when the exciter voltage would fall to practically zero. This would mean that the alternator field (also the exciter field which can be neglected) would suffer a sudden reduction in field current, and the induced voltage would discharge itself through the exciter, the effect being to reverse the polarity of the latter.

To bring the polarity back to normal, run the set up with reverse polarity with the main field rheostat short-circuited, then put in exciter resistance until the exciter voltage falls to the critical point, when the field discharge would right the polarity.

To avoid any occurrence of this trouble, the exciter should be made stable by putting liners behind the poles, or a simpler method would be to short-circuit the last steps of the exciter rheostat, so as to make it impossible to reach the critical point. This would mean that a further reduction in main field current would have to be effected by means of the main field rheostat.

W. H. D.

Manchester, *August 17th*, 1914.

"Too Old at Forty."

The age limit of 40, and the few exceptional cases in which it is graciously extended to 45, as we see by the advertisements, is becoming a matter of much concern among all branches of the engineering trade. In times of peace it is only now and again possible for anyone to obtain a position when he has passed the age of 45. And now, during

the war, the Government seems only to employ men under the above age. Yet we are told there is a great need for skilled workmen! I give two instances this week where the age limit was passed, but the wage limit maintained. One of these was offered to me at 35s. per week of seven shifts of 10 hours each, all extra time as required to be thrown in. There was no limit to the number of hours, but you might be required to work above and beyond the stipulated condition. The second was at 30s. per week, and I was to take charge of station, seven shifts, and to undertake to work all hours necessary to maintain a regular supply. The engineer said that he preferred a man of 25, because he could grind a valve better than older and more experienced men. I leave this to the judgment of your readers. The latter position is now advertised, and the wages offered are 35s., with an age limit of 32. Let me give another experience in time of peace, when conditions were normal. I was selected for a position at £150 a year, although no age limit was fixed. I was asked what number of shares I would take if appointed.

Now, Sir, we over the age limit, in good health, are anxious to assist our country, but, until better conditions prevail, we are helpless. We not only see our gallant soldiers, including our own sons, in the fighting line, but the best of our trade goes to other countries. I suppose one reason for young unmarried men being preferred is because they can exist upon a wage of 25s. to 35s. per week. If this state of affairs is permitted and encouraged, where are the reinforcements of willing men to come from? Those who benefit, I think, are chiefly private employers. It is, I think, a rare thing to find either a director or manager in Municipal and Government work under the age of 45. Inexperienced men in authority are mostly responsible for this system of sweating, and the sooner experience gained by age and work is recognised, the better the country will be able to continue its industries without stoppage, under all circumstances over which we have no control. Such a recognition would be a great blessing to men over 45, not only to engineers, but to those of all classes. Many of us are strong, fully able to do all the work required, and with a richer and riper experience than we had formerly. I trust those over the age limit will think better of their behaviour towards us and give us the opportunity to prove our worth at the wage which is necessary for married men. We hear much of patriotism. Why should strong, able-bodied, skilled men in a time of emergency, be refused an opportunity of employment? They are at least as patriotic as the rest of their countrymen.

A. E. Short.

London, N., *August 17th*, 1914.

Manufacture of Carbons.

I should be very much obliged if you or any of your readers could refer me to any publication or printed matter relating to the manufacture of arc lamp carbons or electrodes.

Carbone.

August 17th, 1914.

The War and Trade.

There are many evidences of a tendency on the part of purchasers (by no means the smallest) to take advantage of clauses in their contracts to suspend and delay work on account of the war; and the members of this Association, who employ tens of thousands of working men, are already so affected in respect of contracts representing over a million pounds sterling.

Should such suspension and delay become at all the common practice, the result, for working men, would be disastrous.

One of the primary duties of every Britisher at the present moment is to maintain employment as far as ever possible; and my Council desire to appeal for the prompt and sympathetic consideration of this question by all present or prospective purchasers of electrical goods, and goods used in connection with electrical work.

Our own Government, by common consent, has set an excellent example, financially and otherwise, and has given every assurance towards allaying traders' fears.

The Colonial Governments have done the same; notably the Australian Government, who have publicly exhorted their own importers to keep up and extend trade with Britain, recognising at once the extremely important issue involved, both now and in the future.

On behalf of the Council of this Association, I commend this matter to your earnest consideration.

F. R. Davenport,
Chairman of Council, The British Electrical and Allied Manufacturers' Association.

London, W.C., *August 14th*, 1914.

THE WAR AND THE ELECTRICAL INDUSTRY.

Our correspondent in the Yorkshire West Riding sends us the following as the result of special inquiries:—

It would be difficult to find any other trade in the Yorkshire textile district in which the war has occasioned less disturbance than in the electrical industry, if it is regarded in total. The sources of raw material are, of course, restricted. In some small measure skilled labour has been called to the fighting front, but the withdrawal has been mainly of unskilled labour, which could be replaced without any great difficulty. Credit has to be extended somewhat, but is not materially shaken. Work in progress is delayed, and for the home market many orders are suspended indefinitely, but the way that orders are coming in is surprising, and indicates in a remarkable fashion the confidence which the British people have in the future of this country, notwithstanding the perils of the time, and the feeling everywhere outside of the enemy's territory that Great Britain is standing on an immovable basis.

The largest of the electrical manufacturing places in this district are now working night and day in full shifts. There is no prospect of any diminution of that activity, and though even the first call of the country for Reserves—those on the Naval Reserve—took many labourers from the test beds and other departments, the deficiency was soon made up. Inquiries are coming in practically as freely as before, and new orders are fully three-fourths of what might have been expected at this time of the year if peace conditions had prevailed. Of course, there will be certain limitations, particularly in the nearest market, that of the textile West Riding itself. Further electrification of textile mills is not within reasonable probability at present, for the staple industry of this district has been badly hit by the war. It sends goods to Germany in normal times in heavy quantities, particularly of yarn, and Germany owes it a great deal of money, as to the chances of ever getting which, perhaps, the less said the better. For want of the money due by foreign countries, mill developments must be arrested in a very large measure indeed. The only textile mills which are busy are those working on khaki. Of the others it is a gruesome fact that all who can do so are turning their attention to the production of black goods. Then, again, Corporations realise that their possibilities of rate laying must be contracted, and are now restricting their electrical orders to the narrowest possible limits, so that developments in this direction may be much restricted. *Per contra*, there are the possibilities arising from the activity of those industries engaged upon goods required in the war, the number of which, presumably, will make an ever-widening circle until peace is declared. And also it would be like shipping coals to Newcastle to remind observers of the fact that German competition in respect of anything in this country is ended for the present. *A propos* of this point, however, the extent to which orders placed in Germany before the outbreak of the war have failed in execution, and are never likely to be executed now, is a material consideration. There is, for example, the instance of the turbo-alternator ordered by the Bradford Corporation from a German firm a few months ago at a cost of about £10,000, and not delivered. War, or no war, the Bradford Corporation must have that machinery—the ordering of which from Germany, it will be remembered, roused such indignant protest from manufacturers in this country—and in all human probability Germany will never supply it. In regard to a host of orders, German competition has ceased not only prospectively but retrospectively; and though the cheap Belgian steel and German copper will no longer be available to the English electrical manufacturers, and the cost of such raw materials will probably go up 20 per cent. or more, the consumer will have no option but to pay.

Whilst on a balance of gain and loss the total effect of the war on the home market is expected to be somewhat restrictive, and the distributors in that market are rather anxious as to the effects of increased prices and long credit and doubtful solvency in the cases of some of their local customers, the brightest hopes are entertained of the over-sea trade so long as the British Fleet can continue to render the magnificent service that it had been doing for the nation up to the time of the writing of these notes. The extent to which German competition had cut out British business

in foreign and colonial markets had not been quite fully realised here before the outbreak of war led people to examine the position rather more closely, and now it is taken for granted that, first, by effect of the actual suspension of production in Germany, and the practical, if not complete, paralysis of shipping from Germany, and later, on account of the world-wide sentiment of resentment against the German nation and the universal injury inflicted by its plunge into war, the competition from the Fatherland will be ineffective for a long time to come. It is pointed out that there is absolutely nothing in the electrical industry for which the world is dependent upon Germany or which cannot be supplied by British makers; and, therefore, so far as the open sea routes are concerned there should be no diminution of demand, but merely a concentration of requirements upon the books of British and American makers, with a large part of this increment coming the way of this country. Especially is the benefit in this direction expected to be derived from Canada and Australia, which hitherto have been largely supplied by Germany. One of the largest merchant buyers of Canada said to a traveller from this district, less than a month ago: "There is absolutely no chance of your doing business here. We are fixed up with a large German house who give first-class supplies and excellent deliveries, and we are fully contracted up with them for several years." And now that is all a thing of the past. In dynamos almost the whole of the trade below 1 H.P. has been done by the Germans, and that has been a tremendous handicap to the smaller English firms which will now be removed.

The Yorkshire electrical machinery makers are, indeed, already inundated with applications for places on the staffs by people who have been representing the German houses in this country, and recognise that their occupation has gone.

The only thing needed, in the judgment of the electrical people whom our correspondent has seen with reference to the matter, is the maintenance of confidence and credit, and in this part of the country, at any rate, there are no fears. A little fright on the part of one or two of the local banks in the first days after war broke out, has been quite overcome. It was due chiefly to the fact that the textile trade is so largely run on the basis of bills. Now that the Government have arranged to back the Bank of England in dealing with bills, confidence is fully re-established hereabouts. Sufficient assurances have been given by customers as to payment; and orders for electrical machinery and appliances are being taken freely without it being considered necessary to improve any abnormal conditions at all.

A few words only in conclusion need be said in regard to labour and employment. There does not appear at present to be the remotest fear of short time; but if diminution of labour should become necessary the general intention throughout the textile district of the West Riding is to keep all men going and so distribute the wage loss evenly over the staffs. Very little skilled labour has been withdrawn from the electrical industry for active service, either on our side or the enemy's. The great exodus of Germans from Bradford and Leeds related almost wholly to the textile houses. It is not too much to say, therefore, that so far as the industry in this district is concerned, there has been absolutely no loss of human efficiency that could not at once be made good.

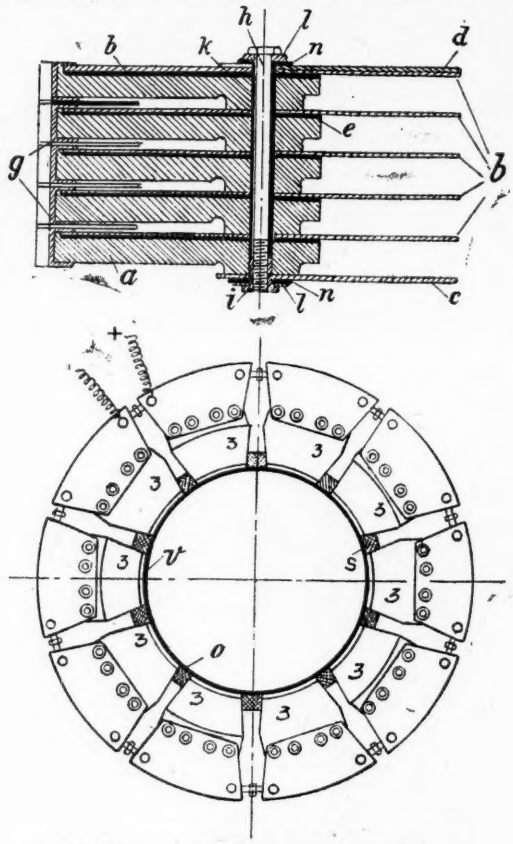
Our correspondent finds nothing but optimism among the representatives of the industry in this district in conjunction with a pronounced wonder and thankfulness that, on the face of things, affairs look so well under such a trying test, and praise is being lavished upon the Government in respect of the measures which it has taken for securing public safety and averting public panic.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Thermo-Electric Generator.

An apparatus has been devised by J. Marschall, of Dresden, with a view to overcoming the difficulties hitherto experienced in the thermo-electric generation of electricity and to making the system practicable on a fairly large scale. The Marschall "thermo-column" consists of an aggregate of flat cells shaped as shown in fig. 1; the inner ends of the elements, which are heated, are metallically cemented together by electrolysis, while the outer ends of unlike elements of adjacent cells make contact with one another and carry metal cooling vanes. The cells are bolted together in groups, which are nested round a central heating tube as in fig. 2, and the whole is enclosed in a casing through which air is circulated to cool the exposed ends, whilst highly-heated gases pass through the heating tube. Solid fuel may be used, burnt in an external furnace, or oil or producer gas. The cells are connected up in series or parallel-series according to the voltage required.

The positive electrode is composed of a special alloy and the negative of an alloy of copper and nickel, stamped in the form of a plate. Mica or asbestos separates the two electrodes of each cell. In an experimental apparatus 800 cells were employed, in groups of five. The external dimensions were 2 m. × 0·65 m. × 1·35 m. high. It is stated that the consumption of fuel was 2·5 kg. of lignite per KW.-hour, costing ·7d., and the apparatus is said to have cost £32 10s. per KW. of output to manufacture. Starting from these figures, the promoters build up estimates showing a yearly output of 7,500 KW., and net profits of £120,000 a year. According to Prof. Kollert, of Chemnitz, with a hot-junction temperature of 369° C., falling to 56° at the cold junction, the E.M.F. of a single



a, b, electrodes; e, k, n, insulation; h, i, l, clamping pin, &c.; c, d, auxiliary plates; v, heating tube; 3, 3, element piles.

Figs. 1 & 2.—Marschall Thermo-Electric Generator.

cell was 0·077 volt, and with a current of 28·2 amperes the P.D. was 0·0412 volt, the internal resistance, therefore, being 0·00127 ohm and the useful output per cell 1·162 watts.

Electric Drive in the Bakery.

In the bakery business, where it is impossible to secure too good a production of the manufactured article, the regular and uniform driving of the machinery, especially in the preparation of dough, is of the utmost importance. Fig. 3 shows two Vickers motors, each of 15 H.P., operating a large dough mixer and a machine specially designed for the cutting up of dough into biscuit form,

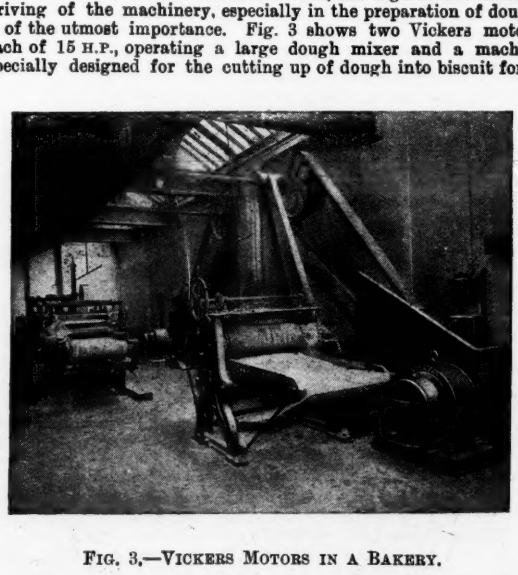


Fig. 3.—Vickers Motors in a Bakery.

and delivering same to the ovens ready for baking. A smaller Vickers motor of 7½ H.P. is also to be found in another part of the premises.

Each control gear set is of the Vickers well-known double-automatic panel type, with 100-ampere double-pole ironclad switch and fuse, and an ironclad three-way D.P. distribution box, for use in connection with the motors. All the apparatus is suitable for use on a 460-volt circuit.

The motors and switchgear are installed on the premises of the Far-Famed Cake Co, Ltd., Bromley-by-Bow, and the whole of the installation and wiring work was carried out by Messrs. J. B. Marr & Co., of 53, Victoria Street, S.W.

Wotan Traction Lamps.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, have been engaged in the production of lamps for traction purposes for the past five or six years, and their tantalum traction lamps have been used on all the principal tramways and electric railways. They have now introduced a new Wotan helical traction lamp with a spiralised filament carried on a spider in the usual Siemens manner, but instead of being wound up and-down, as has been the case previously, the spider is arranged so that equal

Fig. 4.—Wotan Traction Lamp.

lengths of filament are carried vertically and horizontally. By this means neighbouring lengths of filament do not run parallel to each other, as with the existing method, which is liable to cause twisting or short-circuit of the filaments owing to vibration, but are set at right angles, and no bend is greater than a right angle. In practice, therefore, it is impossible to obtain a short circuit even under the most violent jars or vibration, and the lamp is equally strong when used in any position. The new arrangement accounts for a considerably increased spherical candle-power, as the light given is practically uniform in all directions other than the cap-end. The distance between the top and bottom supports of the spider is in no case greater than $\frac{3}{4}$ in., in order to provide the lamp with a mechanical supporting strength hitherto unobtained, and it is practically impossible to break the filament or stem without breaking the glass of the bulb.

Most exhaustive tests have been carried out on these lamps under severe artificial conditions of vibration and on rolling-stock in use, and with every satisfaction.

The Fullarton Vibrometer.

The above instrument has been introduced by Messrs. Kelvin, Bottomley & Baird, Ltd., of 16, Cambridge Street, Glasgow, to enable the engineer to measure the comparative intensity of vibration of running machinery from time to time. As with a large machine vibrating, everything about it is also in a state of vibration, an instrument is required which can be securely attached to the machine itself, and which will vibrate with it and operate independently of any fixed point.

The Fullarton Vibrometer is light (weighing $1\frac{1}{4}$ lb.), rigidly built, and so constructed that it can be easily attached to turbines, generators and such plant.

Fig. 5 shows a complete instrument ready for use. It consists of a frame C, with a spanner-shaped arm A suitable for clamping to the machine.

The frame carries a vibrating reed R, of flat metal, of known uniform thickness, clamped at the bottom H, while the carrier body on which the frame moves is provided with a spring-jaw K, embracing the reed and forming the base about which it vibrates. By manipulating the screw D, the free end of the reed is altered in length and "tuned." A millimetre scale on the side of C gives the free vibrating length of the reed, while the amplitude of vibration is measured on a moving scale G at the top of the sliding frame. Different thicknesses of reeds may be used for different speeds, and it is evident that the instrument may be used as a frequency indicator, or as a check on speed indicators attached to the machine.

The reeds are carefully calibrated for every instrument sent out, and "speed, reed length" curves supplied with each vibrometer.

In taking readings it is necessary to tune until a maximum amplitude of reed vibration is obtained, and the instrument is constructed so that it can be turned about both its vertical and horizontal axes until this is found, the angles in each case being indicated on scales provided.

With turbines which are only out of static or knife-edge balance, the vibration will be in a plane at right angles to the shaft, and the maximum will usually be found when the top of the instrument is leaning outwards from the shaft at an angle of 10° to 15° to the vertical.

With some machines out of dynamic balance the maximum resultant vibration is not in a plane at right angles to the shaft,

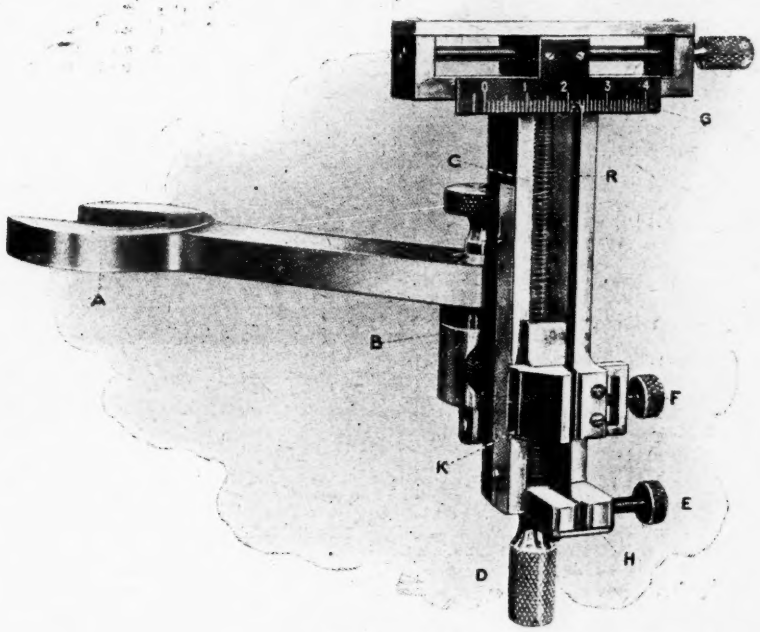


Fig. 5.—The Fullarton Vibrometer.

and the instrument must be turned in a horizontal plane to adjust for this.

The vibrometer is claimed to provide a ready means of investigating vibration problems in high-speed rotary plant; folded away neatly in a case, the weight complete is 3 lb.

WAR ITEMS.

Owing to the unsettled conditions due to the war, the General Electric Co., Ltd., inform us that they find it necessary to withdraw all outstanding quotations and special terms, and may be prevented from adhering to guarantees with respect to deliveries. All their factories are being kept open, and large stocks are available.

The Walsall Electrical Co., Ltd., have had to withdraw all outstanding quotations owing to the rise in price of raw material.

Messrs. A. P. Lundberg & Sons write pointing out that they are not dependent on Continental supplies; they have no factoring interests, and are essentially an English manufacturing firm of over 32 years' standing. Their senior partner is a naturalised Englishman of Swedish birth, who has resided in this country for over 50 years; the junior partners are London born, the sympathies of the firm are entirely British, and their capital is all invested in this country.

Mr. John Pendreich, of the Pendreich Electrical Firm, Edinburgh, begs to announce that his address is as follows:—S/25511 John Pendreich, Army Service Corps, on the Staff of Supply Officer, Divisional Troops, 3rd Division, British Expeditionary Force, in France or Belgium.

Messrs. H. Hartjen & Co., state that theirs is a British firm, of which the sole partner is an Englishman born; the name alone is of foreign (Norwegian) origin.

A fund for the relief of dependants of tramway and electric supply men who are called on service has been established by about 40 tramway and electrical companies in the British Electrical Federation. It provides for the companies subscribing an amount equal to the total contributions made by the employés who remain at work. The contributions of the companies will not be less than 3d. per week in respect of every man in their employment.

Owing to the war the Dartford coal contract for the U.D.C. electricity works has been declared off. The Council has authorised the Electricity and Tramways Committee to purchase supplies as may be necessary.

Messrs. H. Wiggin & Co., Ltd., of Birmingham and Sheffield, announce that owing to the increased price of raw materials they have been compelled to advance the price of German silver by 1d. per lb. all round, with the exception of cut out and stamped blanks.

The Yorkshire Electric Power Co. have made generous arrangements for helping the wives and children of Reservists employed by them and who have been called up for service.

Messrs. Brown & Co., of Waterloo Sawmills, Glasgow, announce that owing to the war, which is causing the cessation of shipping from ports, timber and other raw materials are not forthcoming, and as stocks in the district are exceptionally low and prices high, they are obliged to intimate an advance on present prices. Advances may continue from time to time owing to circumstances.

The Hoffmann Manufacturing Co., Ltd., of Chelmsford, Essex—an entirely British concern—is working at full pressure. Although the staff has been considerably depleted by the "Call to Arms," matters have been swiftly adjusted, so that there will be no delay in execution of bearings orders in hand, many of which are for contractors to the Admiralty and War Office.

The India-Rubber, Gutta Percha and Telegraph Works Co., Ltd, of Silvertown, have decided to pay half wages to the wives or dependants of all employés called up, throughout the period of their service with the forces, and, in addition, to find employment for them on their return.

The directors of Messrs. Ibbotson Bros. & Co., Ltd., steel manufacturers, of Sheffield, are asking their shareholders to sanction the expenditure of £10,000 for providing for the needs of wives and families of employés serving in the war.

National Relief (Prince of Wales') Fund.—At a meeting of the City of London Committee at the Mansion House, on August 11th, the following resolution was unanimously passed:—"That this Committee, called by the Right Hon. the Lord Mayor to consider the question of distress arising from the state of war, urgently and respectfully appeals to all employers of labour in the City of London to do their utmost to avoid distress by providing whole or part employment for their employés."

As might have been expected, merchants and manufacturers in the United States have not been slow to recognise that they have the chance of a lifetime to secure large business in markets which they could not successfully enter previously. The New York correspondent of the *Times*, in alluding to the matter, says that the vast supplies required by the belligerent nations can be more readily obtained in America than elsewhere, as they will be free both to produce and ship goods. This, it is considered, should afford American business houses generally an exceptional opportunity for increasing their trade, especially in South American countries, by capturing a large part of that heretofore enjoyed by Germany. To this end official information is being promptly prepared for the guidance of American manufacturers, exporters and others, showing the extent of the commercial and financial dependence of South America upon Europe. It is urged, however, by those in authority that any such steps should be taken on the basis of assisting South America, that is with a view to securing immediate benefit rather than capturing permanent trade connections.

The *Times* says:—"Over 100 mills in the Welsh tinplate trade, which has Swansea as its centre, are being re-started, and this will give direct employment to over 5,000 men, and indirectly to many more. With competition from Germany eliminated, a boom in the Welsh tinplate trade is expected. Prices have already risen."

Sir Algernon Firth is reported as follows in an interview recorded in the *Daily Telegraph*:—"Very shortly there will be nothing to prevent our export trade, except to the Continent of Europe, going full speed ahead, and, if I have any suggestion to make as to the direction our activities should take, it would be that we should seek out where the Germans have been doing business up to the present, and take it from them. On this point, the statistics of exports from the German Empire, as published in our Blue Books, are worth careful study, and I intend shortly to issue a statement on this subject through the Association of Chambers of Commerce." Sir Algernon said that the future was full of hope. The Government, aided by the best men of both parties, had done marvellously well in dealing with a situation of unprecedented difficulty and magnitude, and it was for our traders now to go ahead with confidence and courage.

With reference to the important movement now on foot to render this country and some other large markets less dependent upon German manufactures, the *Standard* says that London business men are planning a well organised campaign to this end. We hope that British electrical manufacturers will take full note of what is being done in this general trade connection, and endeavour to follow it out in connection with our own particular industry. The scheme has been initiated by the National Patriotic Association, which exists primarily to prevent distress and assist recruiting, and which soon discovered that many British wholesale firms were at a standstill, as they could not obtain the German-made goods in which they dealt. The Association thereupon set itself to put these firms into touch with English manufacturers, and this plan has already met with great success. Important daily conferences have been taking place at 32, St. Paul's Churchyard, E.C., between importers and manufacturers. The former put on the table samples of the goods they have been getting from across the North Sea, and state the price they have been paying. The British manufacturers then discuss with them whether we in England cannot step in and take Germany's place. Where this is assured the threatened unemployment is, of course, at an end. What may prove finally of much more importance, is the hope that during the war we may grow used to making goods on the German system, and thus obtain a grip on the world's commerce which Germany will never in the future be able to force us to release. In the opinion of many well qualified to speak, the present war will largely solve the problem of unemployment in this country. This is, of course, only if business men here grasp the opportunity that now presents itself.

Sir George Pragnell, the chairman of the Association, is reported thus:—"Now is the opportunity for our manufacturers to get together to study German samples, prices, and methods in order that our own factories shall in future make the goods which we have hitherto obtained from Germany. Our own manufacturers should carry the war into the enemy's commercial camp, and so secure a large proportion of German trade all over the world. German manufacturers have closed their works, and it will be a long time before their factories are open again and their travellers in a position to take orders. We have now the finest possible opportunity to secure that business, and so find employment for every British man and woman. What the Germans can do we can do if we rise to the occasion. We must put down new machinery, and utilise new methods in order to secure the German trade."

The London Chamber of Commerce, through a special Committee of experts, has been considering a number of problems relating to contracts in war time, and it has issued a circular to its members respecting some of these. They relate to liability for war risks under c.i.f. contracts, the limitations in regard to dealing with the subjects of alien enemies, payments due by British firms to alien enemies, the legality or otherwise of making contracts with alien enemies, the legality or otherwise of completing during war contracts entered into with alien enemies during time of peace, &c.

A correspondent, writing to the *Near East* under the title "Electrical Goods in Turkey," says:—"Turkey has for long been a large purchaser of German wares, particularly those required for illuminating purposes. Included among them are all varieties of electric lamps and fittings, gas apparatus, and incandescent mantles of all descriptions, for which there has been an increasing demand in the Ottoman Empire for 10 or more years. A report recently issued by the French Chamber of Commerce at Constantinople points out that, with the exception of the competition of France, Germany has enjoyed practically a monopoly in the supply of electric and gas requisites for lighting purposes. Indent agents in Turkey and the Near East are cosmopolitan in their business ideas and business methods. They are just as anxious to fill orders for British as for German manufacturers if terms are anything like equal. We have authority for stating that some of our home manufacturers at least are reversing this, and that within three months Turkish buyers particularly will have price lists and catalogues printed—in their own language—which will convince them that England is still the workshop of the world, with resources even superior to those of the country with which she is now at war."

It is stated that a Territorial while guarding the Metropolitan line near Royal Oak Station was knocked down by a train. He was seriously burned by contact with the live electric rail, and died soon afterwards.

The *Times* reports that the Institution of Mechanical Engineers has offered the use of the vacant top floor (of the extension building) free of charge during the continuance of the war for the administrative purposes of the Prince's Fund. The offer has been accepted, but the Institution has been asked (and it has agreed) to allow the rooms to be used by the Office of Works for the purpose of accelerating the designs and specifications for many public works which it is intended to put in hand as quickly as possible, in order to give employment.

The Commercial Intelligence Department of the Board of Trade, 73, Basinghall Street, E.C., places itself freely at the disposal of British manufacturers in their efforts to capture German and Austrian foreign trade. The Department invites importers of articles from these countries to afford particulars of their precise nature and quality, in order that steps may be undertaken to ascertain whether similar goods can be produced in this country, and if so, where; or if not, from what neutral sources they can be obtained.

We welcome the promptitude of the Board of Trade in proceeding with a campaign to assist and supplement the efforts of British manufacturers and traders to take advantage of the present opportunity to establish themselves in foreign and Colonial markets in branches of trade which have hitherto been largely in the hands of their German, Austrian or Hungarian rivals. On Wednesday morning we received a number of documents and pamphlets, forming part of a series of similar monographs on special groups of trades, which the Board's Commercial Intelligence Branch is issuing in pursuance of this scheme, to British Chambers of Commerce, Trade Associations, and also direct to a large number of British manufacturers and merchants. The trades dealt with in the memoranda already issued are:—Cutlery, iron and steel wire, hollow-ware (enamelled or tinned), woollen and worsted piece goods, and cotton hosiery (stockings and socks).

The next instalment was to be issued in the course of Wednesday, covering electrical machinery and appliances, and cotton prints. Memoranda on a number of other trades, including, among others, furniture, pottery, paper, clothing, chemicals and dyes, certain classes of machinery, boots and shoes, gloves, and certain classes of iron and steel, will be issued in rapid succession.

Everybody recognises how important the matter is from the point of view of preserving continuity of employment for our industrial population, to say nothing of the possible ultimate gain to British overseas trade. We understand that the issue of the circulars and memoranda is only the first step. The Director of the Commercial Intelligence Branch will be ready to receive and answer personal and written inquiries for further information with regard to particular trades and markets. The Board of Trade is also obtaining information through H.M. Trade Commissioners and Consular Officers as to the commercial and financial situation in the Dominions and foreign markets, and particulars on this subject will be circulated in the course of a few days for the guidance of British exporters. We hope that the electrical trades will take advantage to the full of this timely co-operation on the part of the Board of Trade.

It has been decided to postpone the Shipping, Engineering and Machinery Exhibition (Olympia), which was to have been held in September and October, to a period between July 13th and September 14th, 1915, which will be fixed in consultation with the Hall authorities in the beginning of 1915. The Executive Committee placed before the exhibitors two alternatives, one for the postponement as above, and another for cancellation of Exhibition on certain conditions. A large majority of the exhibitors agreed to the postponement of the Exhibition to next year.

Messrs. Marples & Leach inform us that there appears to be an impression that the Adnil Electric Co., Ltd., are solely dependent for their supplies upon German manufacturers, and they request us to reassure the trade on this point. Their Century motors are manufactured by the Century Electric Co., St. Louis, Mo., U.S.A.; of their wide range of electric fans a large proportion emanates from America, and their patent Beedle blade exhaust fans (A.C. and D.C.) are, and always have been, of English manufacture throughout. The firm have arranged to hold a good stock of British-made motors and dynamos.

The Belgian Minister in London has opened a fund to relieve the distressed families of the Belgian soldiers now in the field, who are gallantly defending their country against an unprovoked attack, and to afford help to the sick and wounded. In making this appeal to the British Public, the Belgian Minister feels sure he can count upon their sympathy in Belgium's hour of need. Contributions may be sent to the Belgian Legation, 15, West Halkin Street, S.W., or to Louis Godchaux, President of the Belgian Chamber of Commerce in London, 155, Fenchurch Street, E.C., marked "Belgian Relief Fund." All contributions will be acknowledged through the *Public Ledger*.

Germany has been exporting over £27,000,000 of goods per annum to Brazil, Argentina and Chile. A writer in the *Globe* suggests that manufacturers whose travellers have been diverted from the Continental countries engaged in the war, might consider the desirability of utilising their services wherever possible on ground hitherto worked by the travellers of the big German houses.

We suppose the Press has seldom been so unanimous as it is in its view of the opportunity for increased trade that the war will bring to the United Kingdom. The *Westminster Gazette* remarks:—"Splendid opportunities are being offered to the enterprising manufacturer in certain departments of trade, and if capital can be obtained the end of the war should see new industries firmly established in the country. . . . . The end of the war should see the English electrical industry in a far more secure position than it has occupied hitherto."

The Montreal financial correspondent of the *Times* says:—"Many Canadian manufacturers are favourably affected by the decline in imports from European countries, and will be in a position to handle the requirements of the Canadian market without meeting the usual competition, for the coming season, at least." The New York correspondent of the same paper names a number of important factories—making scales, photographic supplies, shoes, &c.—which have been shut down in consequence of the war. Cessation of exports is described as the cause in certain cases.

We regret to read that the works of Messrs. Howard and Bullough, Ltd., at Accrington, have been closed owing to labour troubles. Although the firm's Russian markets were stopped, they were prepared to go on manufacturing for stock to the extent of a million sterling until the war was over. Nearly 1,000 employés returned to work on Monday, but 500 members of the A.S.E. refused to do so until their terms were agreed to. On Monday night there were riotous attacks upon non-Unionists, and the works have had to be entirely closed, 5,000 workers being thus rendered idle. We cannot believe that the A.S.E. will be prepared to carry responsibility for what can be little short of a catastrophe at such a time.

Considerable alarm has been felt by the cable companies in the United States, according to the New York Press, owing to the reported presence near the coast, of German warships supposed to be watching for an opportunity of cutting the Atlantic cables, but so far the fear has been proved groundless, and confidence has been again restored. Apparently so far the only cable-cutting has taken place at the Azores, where the German cables land.

As we go to press, we learn that the Institution of Electrical Engineers has received about 1,000 replies from electrical men willing to place themselves at their country's disposal. These replies are being rapidly classified and indexed, and the War Office and Government departments have been advised of what the Institution is doing. A circular is being sent out to all electricity supply departments and companies, and lists have been prepared of engineers who are willing to fill vacancies in the public services.

VICKERS EXHIBIT AT THE ANGLO-AMERICAN EXHIBITION.

A usual feature of the Shepherd's Bush Exhibitions, which should this year attract more than usual attention, is the comprehensive display of war and other material made by Messrs. Vickers, Ltd.

Numerous models of war vessels, including a submarine, and examples of modern artillery are on view, and in addition, interesting specimens of metal work, including steel and various alloys—notably duralumin—occupy a prominent place.

The latest practice in high-speed drilling and accurate reaming, with vanadium twist drills and adjustable reamers made by the firm, is shown.

All the machine tools are operated by Vickers motors, with the firm's control pillars, and an electric power and lighting supply is obtained from a Vickers train lighting and ventilating plant.

This lighting equipment has been described in our columns: as an additional feature Messrs. Vickers have developed a type of electric car heater which can be used with it, and two such heaters, of 1,500 and 500 watts respectively, are shown suitable for a 24-volt circuit.

An additional feature of this exhibit is the periodic cinematograph displays, showing launches of battleships, machine shop operations at the Sheffield and Barrow Works, gunnery demonstrations, &c.

LEGAL.

Workmen's Compensation Claim.

At Northampton County Court last week, his Honour, Judge Radcliffe, K.C., heard an application in which Mabel Evelyn Eydmann, widow, made an application under the Workmen's Compensation Act, the respondents being the Premier Accumulator Co., Ltd. Applicant also claimed on behalf of Harold Eric Eydmann, an infant, as next friend.

Applicant's husband, Harold Eric Roy Eydmann was employed by the respondent as an ignition hand. It was alleged that on April 7th, 1914, he was engaged at Northampton generating station, packing up lead-lined boxes; one of them slipped and a projecting piece of lead caught his thumb, from which injury he died on May 31st. The defence was that the accident did not arise out of and in the course of his employment by respondents, also that no notice of the accident was given as required by the Act.

Dr. Pettit, who saw deceased on May 4th, said he told him he had cut his left thumb some time before. There was a healed wound, and as he was suffering from septic poisoning witness sent him home to bed. He died from blood poisoning.

Applicant said when her husband went home to dinner on April 7th, he had a bandage on his left thumb. He did not go to work after May 4th as the doctor sent him to bed. Applicant said she called at the works and saw Mr. Slatter, who said he would write to the insurance company. An appointment was made for her to see Mr. Stevens, but he was in London. She subsequently put the matter into the hands of a solicitor.

Charles Arthur James Waters, general hand employed by the company, gave evidence as to deceased cutting his thumb.

His Honour did not hold with the contention that the respondents were prejudiced through not having notice of the accident. He gave judgment for the plaintiff, and agreed compensation of £243 14s. Stay of execution was allowed upon payment of £30 into Court for the widow's pending expenses.

Licensing Motor Vehicles.

A decision affecting all traders who utilise motor vehicles in the course of their businesses was recently delivered by the Bradford stipendiary magistrate. The case concerned the Bradford Pure Ice Cream Co., Ltd. The question arose whether a motor-car used by the defendants for trade purposes came within the exemptions to duties of excise for carriages as stated in Section 4 of the Customs and Inland Revenue Act, 1888. It was not suggested that the car had been used for any other than the above purposes, or that there had not been some adaptation of the car from its original condition as a pleasure car for such use, but it was contended that the adaptation had not been enough, and that therefore the exemption did not apply.

As, in the present case, the motor-car was not constructed solely for the conveyance of goods or adapted for the conveyance of goods, the magistrate held that it was not exempt from duty, and the defendants were fined 10s. and 7s. costs.

THE PERFECT SYSTEM.

By "COMMERCIAL."

A short time ago an article appeared in a well-known daily, with reference to the methods and system employed in the manufacture of one of the best makes of English motor-car. All the salient points in the whole business were noted; the accuracy of manufacturing detail; the series of exhaustive tests for finished chassis; the comprehensive trials through which all new departures in construction are passed before they are finally embodied in standard specications; all these were duly explained and admired by the writer. Indeed, he seemed to be sure in his own mind that these methods were as exceptional as they were admirable. Now, while we do not believe that any one firm has a monopoly of the best modern methods, whether in the motor-car or any other trade, it may be profitable to run over a few points which go to constitute what is termed "system," in order to see where we are lacking, or not in line with others.

Naturally, all will admit that different businesses need different systems; that goes without saying. Yet just as book-keeping is essential for all business people, whether they sell pills or motors, so the main ideas are applicable, in considering a factory system, to all trades. In the same trade, however, one often finds quite different systems. Some are of the simple, conservative, easy-going sort, while others are much too complex. The faults of the latter are generally that, in the first place, work is often duplicated unnecessarily, involving a larger staff, and that the very intricacy and completeness of the system tends to hinder rather than help. The whole question may be divided into three sections: Materials and stocks; orders, and methods of dealing with same; and workers and their management.

Materials and Stocks.—In the matter of what Free Traders call raw materials, most people to-day work on short stocks, with a fixed maximum and minimum according to works' normal requirements for the various articles. Supplies emanating from an outside source are more likely, as a rule, to be delayed, than those made on the premises, *e.g.*, castings, which may either be supplied by another firm, or made in one's own foundry. More latitude, both in the time allowance and the maximum for stock should, therefore, be allowed in the former case. This is very important to-day, when orders are often placed largely, if not wholly, on delivery, prices being in many cases so much the same. On the other hand, when trade is booming, and work is booked up, perhaps, for months ahead, some discrimination is necessary in requisitioning materials for immediate delivery, the assembling of which may not take place for a comparatively long period. Valuable room in shops and stores is occupied, confusion is rendered more likely, not to mention the fact that payment must be made so much earlier than otherwise would be the case. We must remember that the oftener material is bought, turned into finished goods, and sold, with the use of the same capital, the greater the aggregate earnings at the year's end.

Orders, and Methods of Dealing with the Same.—Many people seem to think that, to secure quick delivery of an order, it is only necessary to mark it "Urgent," "At once," or "Wanted immediately." In a well-conducted factory such terms fail to convey any meaning. The reason for this is that there are so many orders with definite dates of delivery—some of them very short—and others with a penalty time-limit, that as a natural consequence the remainder must perforce come afterwards in something like rotation. Therefore, no notice can be taken of any of the above or similar hackneyed phrases. All jobs required to a certain time should be followed up throughout the entire manufacture, regularly and systematically. It is almost useless to do this spasmodically, for no real time saving can be effected without continuous effort in this direction. Foremen should be consulted in turn, so that all possible arrangements can be made in anticipation of the arrival of the work in their respective shops. Missing material must be urged forward in order to obviate any loss of time, and the various processes all arranged to come to the end before the stated time expires. In some works a "chaser" is employed specially for this purpose. This leaves foremen free to attend to the work which they have, and saves them from having to run about for work which they require. As each department is ready for it, the job comes along. A works chaser must possess a practical grasp of his business, and be able to gauge to a nicety the times required for various classes of work. He must not be merely a messenger. Some one person, if not more, must look after those orders which are required promptly, and it is more economical and satisfactory, where the nature of the business permits, to engage one man solely for this work, than to have several high-salaried men spending part of their time chasing such orders. In the absence of a special man it sometimes becomes a case of everybody's business being nobody's business, and the customer is let down. In addition to the duty of following up specially urgent orders, it should be incumbent upon the works chaser to have prepared for him by the order office lists of the oldest orders unfinished. This might be done, say, every month, or twice monthly, and in this way such orders can be looked up and pushed through.

Workers, and their Management. — The methods of supervision employed over the staffs and manual workers by the responsible heads of works form a part of their whole system just as much as the methods used in connection with those matters already discussed. The manner of such supervision goes far to make or mar the success of any firm. For instance, it does not count in favour of any business system to allow a constant succession of changes in the staff. Men are trained in the special details of the work, and become accustomed to the routine, only to leave in a comparatively short time, just when they are beginning to pay for themselves. The reason of this will be seen later. This habit of constant replacement of men is a drawback to more than one firm in the electrical industry to-day. The people at fault are the heads of the firms. In some industries—perhaps even in the electrical business—there are cases where many of the employés of a firm have been in the same service up to even 50 years. Now, if long service be a virtue, as much in the firm as the workman—if it is a recommendation of the good methods and respectability of a firm, then there are some firms in Britain to-day whose reputation in the matter of solicitude for their workers will not bear the most cursory inspection. Just as the most elaborate system cannot carry with it a guarantee of a large dividend, so the firm which hedges its men about with the most restrictions, and drives them to the last minute, does not always ultimately secure the best men or the best service. Their system may be the last word in completeness, their equipment of shop, office and laboratory unequalled, their self-confidence in the merits of their products all sufficient—yet if they treat workers as machines or niggers, if they discharge one after another in a vain search after the perfect and infallible being, and expect to get him for next to nothing, they will never be much better off than their less ambitious neighbours, in spite of all their pains.

No conscientious workman needs a foreman to stand over him. He wants to be left alone with his work. When he cannot feel safe for five minutes, when his progress is interrupted by officious jacks-in-office, who question and cross-question, then the quality and quantity of his work suffer, and, especially in clerical work, mistakes are made which tend to give him a bad character. From his short experience the writer ventures the opinion that less mistakes are made when the pressure exerted upon workers is confined within reasonable bounds, than in places where the discipline is of a strict, "keep moving" variety.

To bully-rag a body of workers, either manual or clerical, as though they were a squad of raw conscript recruits, will not answer in an ordinary business house, yet there are people who would seem to model their business on a military footing, and expect identical results. Terrorism is a poor tool wherewith to run a factory. More give and take is sometimes needed 'twixt master and man. One models a system having regard to the peculiar characteristics of the trade. So one may, perhaps, profitably choose the way and means of governing workers, with a little thought as to their welfare, security of tenure, and ultimate efficiency.

RECORDS OF PROGRESS AND COMPLETION OF MANUFACTURING ORDERS.

In every well-ordered manufacturing and construction undertaking one of the salient, and at the same time interesting, features of the executive administrative organisation centres in the efficiency of the section or department whose duty it is to see, upon the receipt of the notification of the acceptance of a successful tender, that the necessary machinery is put in motion for its fulfilment, which means, in general terms, the prompt issue of instructions to the departments or shops concerned, the noting of their requirements and progress from time to time, and generally the taking of such steps as are necessary for the efficient satisfaction of the contract entrusted to the undertaking. It will be at once recognised that the responsible head of the executive department, in order to give due effect thereto, will have installed certain arrangements or devices of which the succeeding memoranda is merely suggestive. For example, we may have a form or forms arranged on the following lines, supported by copies of specifications and instructions issued to enable the works manager to pursue each work or contract from its inception to its completion :—

Subject in brief particulars of order .....
Date received .....
Date for delivery or completion .....
Penalty .....
Number or designation of order .....

Instructions to Works.

Shops instructed.	Date instructed.	Date for completion.
A		
B		
C		
D		
E		
Cost Clerk.		
Storekeeper.		

Testing :

Particulars of Orders placed with Outside Firms for Construction or Manufacture of Parts.

Date.	Name.	Particulars.	Date for completion.

With regard to materials and stores, we may employ a form or series of sheets somewhat similar to the following, which is prepared for all materials and stores required for production. It is then passed to the storekeeper, who indicates thereon by distinctive signs whether he has the necessary material or stores in stock. As to the items not in stock, when the sheet is returned to the drawing office steps are taken to order the material required and the storekeeper advised. He is also instructed to reserve those portions and descriptions of stores which are in stock for the jobs or contracts in relation to which the drawing office inquiry has been made.

Stores and Material Form.

No. of sheets .....
Working number .....
For.....

No. of item.	Shop.	Quantity.	Quality.	Material.	Description.	Drawing letter.	Drawing No.	Pattern : size.	In stock.	Not in stock.

BUSINESS NOTES.

Cab Signalling.—The International Railophones, Ltd., of Birmingham, have sent us a brochure, by Mr. H. von Kramer, discussing the above subject, and explaining the advantages of the Railophone for the purpose.

Lead.—Messrs. James Forster & Co. report as follows under date August 15th :—"We have not sent out our usual weekly circular since the war began. The Metal Exchange being closed, transactions which have taken place have been negotiated privately. The War Office has bought a large quantity of prompt lead and early arrival lead, paying £22 to £23 a ton for it. Such purchases have resulted in a scarcity of prompt lead, for which up to £24 a ton has been paid. It cannot be said, however, that there has been great pressure on the part of consumers, who seem to be pretty well supplied, but those who wanted early lead have had to pay big prices for it. Are these prices to be maintained? We doubt it, and our reasons are :—(*a*) No lead can be shipped from Spain or America to Germany or Russia while the war lasts ; (*b*) all the lead afloat from Australia (and we know there is a large quantity) must come to this country ; (*c*) the lead sold by America c.i.f. Germany and Russia will come here. If there is no manipulation, we ought therefore to have plenty of lead and lower values. It is a strange fact that the Lead Convention controls practically all the soft lead imported into Europe, and that the sale and control of such lead, about one-third of which is produced by the Broken Hill Proprietary Co., of Australia, a British concern largely owned by English people, should be in the hands of a firm in Frankfurt, the members of which are subjects of the German Emperor. We hope that the Broken Hill Proprietary Co. will see that such an arrangement as it exists is not a patriotic one."

Ediswan Lamp versus Lightning.—During the severe thunderstorm which passed over Dublin district last week, the overhead wires of the Dublin and Lucan Electric Railway were struck by lightning. The glass support of one of the Royal Ediswan "Downlite" lamps was fused, but on examination the filament was found to be intact. This is conclusive proof of the wonderful strength of these filaments. The actual lamp is on show at the Dublin depôt of the Edison & Swan United Electric Light Co., Ltd.

Private Arrangements.—G. W. Hill, electrical engineer, 13, Park Parade, North Finchley, London, N.—A meeting of the creditors of the above was held on the 14th inst., at the offices of Messrs. H. H. Wells & Son, solicitors, 17, Paternoster Row, E.C. The statement of affairs presented, showed unsecured liabilities of £177, all of which were due to the trade, while there were preferential claims of £24 10s. The assets consisted of stock in trade estimated at £15, and book debts expected to produce £76 10s. It was reported that the debtor started trading in 1906, with a capital of about £50. He traded successfully for a number of years, but latterly had suffered through bad debts, and also sustained a loss in connection with a picture palace which he fitted up at Poplar. The solicitor stated that the present position was probably due to loss on contracts, as those engaged in that business in Finchley cut their prices very finely. The debtor wished to continue the business, as he believed he could make it pay in the future. No particulars could be given as to the trading as the debtor had not kept proper books of account. The debtor first consulted his solicitor in June, when he believed he could borrow £100 from friends. That money, however, was not forthcoming, and consequently the meeting had to be called. Several creditors had commenced proceedings. The debtor made an offer of a composition of 7s. 6d. in the £, payable as to 2s. 6d. in cash, and the balance in three months. After a short discussion it was decided to accept the debtor's offer. The following are among the creditors :—

Armorduct Manufacturing Co.	£45
Sloan Electrical Co., Ltd.	20
Jaeger Bros.	26
General Cable Co.	12

Bankruptcy Proceedings.—*Re* Trubie Moore, of 75, Headingley Mount, Kirkstall Lane, Leeds, electrical engineer.—A meeting of the creditors in the above matter has been held at the offices of the Leeds Official Receiver (Mr. H. Clifford Bowling), and a statement of affairs has been presented showing gross liabilities amounting to £165 expected to rank for dividend at the same amount, and assets estimated to produce *nil*. The only creditor in the case is the Bradford and District Bank, of Park Row, Leeds, their debt amounting to the total of the deficiency (£165), and representing the balance due under a joint and several guarantee given to the bank on August 29th, 1912, by the debtor and Frank Scott Walfork, for £500, to secure the account of the Sterling Engineering and Automobile Co., Ltd. The estate was left in the hands of the Official Receiver, and the public examination will take place on September 8th.

Frank Herbert Watts, electrical engineer, trading as "Nunn, Watts & Co.," at 40, Mincing Lane, E.C.—This public examination was held on Tuesday before Mr. Registrar Hope, at the London Bankruptcy Court. The statement of affairs showed liabilities £725, against assets valued at £172. Replying to Mr. J. B. Knight, Official Receiver, the debtor stated that having for many years been in employment as a marine engineer, he, in October, 1901, joined two others in the business of electrical and general engineers, carried on at 82, Mark Lane, E.C. He paid in £125, as to £50, his savings, and the balance a gift from a relative, for a one-third share in the business, which thereafter was conducted under the style of "Nunn, Watts & Co." In 1903 and 1904 respectively, his partners left the firm, and witness had since carried on the business alone under the old trading name, removing early in 1912, to 40, Mincing Lane, E.C. The business paid fairly well up to about 18 months ago. In May, 1913, witness entered into contracts to execute the electric installation of two picture palaces, one in the Walworth Road and the other at Romford. The cost of those works considerably exceeded the contract price, and showed a total loss of about £180, whilst later in the year he sustained a further loss of about £45 on two similar contracts. Early in April last his largest trade creditors demanded the immediate payment of their account ; he then went to a firm of accountants, who advised a deed of assignment being executed, but the principal trade creditor declined to agree to the terms and made him bankrupt. Witness attributed his failure

and insolvency to want of sufficient capital, loss on contracts, and a loss of £200 invested in "National Enterprises, Ltd." The examination was concluded. The following are the principal unsecured creditors :—

British Prometheus Co. ..	£18	Haywood & Co., W. G.	£24
Crypto Electrical Co., Ltd. ..	55	Micklewright & Co., Ltd. ..	61
Cryselco, Ltd.	22	Hankin, P.	203
Drake & Gorham, Ltd.	24	Seagrove, Woods & Mitchell ..	16
Falk, Stadelmann & Co., Ltd...	31	Veritys, Ltd.	209
Feld Bros. & Co., Ltd.	13		

C. H. Kitching, plumber and electrical engineer, Kingston-upon-Hull.—Debtor's application for discharge was granted, subject to suspension for two years (July 20th, 1916).

Catalogues and Lists.—Messrs. Lacy-Hulbert and Co., Ltd., 91, Victoria Street, S.W.—Two-page leaflet illustrating and describing the Boreas garage air-pump and equipment for tire pumping and blowing dust.

The British Thomson-Houston Co., Ltd., Rugby.—Leaflet No. 7,632 giving particulars, prices, &c., of the B.T.H. electric quick boiling kettle. Also 8-page leaflet, No. 5,250, illustrating and describing, with prices, &c., the B.T.H. hand-operated starting compensators for polyphase squirrel-cage induction motors.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Copies of pamphlets No. 207, dealing with dividing boxes with mesh connections; No. 194, on rotary isolating switches; No. 1, on quick-break switches; No. 162, on fuse wire for the firm's self-aligning fuse handles; No. 187, on plug boxes; No. 93, on oil-cooled totally-enclosed motor starter; and No. 192, describing a "definite time-limit" device. These are for inclusion in the firm's catalogue, and contain illustrations, prices, and full particulars.

The Dudbridge Ironworks, Ltd., Stroud, Gloucestershire.—Illustrated pamphlet, No. 105, describing the Dudbridge petrol and alcohol engines, of 3 to 60 B.H.P. Dimensions, prices, code-words, &c., are given.

Messrs. Alfred Herbert, Ltd., Coventry.—"Monthly Review of Modern Machine Shop Practice," 1,808, Vol. 2, containing much interesting information on the use of automatic turning machines.

Temporary Assistance.—Without prejudice to the interests of those members of their staffs who are serving their country in the ranks, many firms will doubtless feel the necessity of engaging temporary assistance during their absence. In such cases they may find the International Correspondence Schools, Ltd., Kingsway, of service. We may mention also the Electrical Trades Benevolent Society in this connection.

Meter Approved.—The B. of T. has approved of the "Met." single-phase A.C. two-wire watt-hour meter, Type T.O., deposited by C. H. W. Gerhardi, of 48, Cranley Gardens, Palmer's Green, N., on October 20th, 1913.

Book Notice.—"Motion Picture Operation." By H. C. Horstmann and V. H. Tousley. London: S. Rentell & Co. Price 8s. 6d. net.

Liquidations and Dissolutions.—The Demon Vacuum Cleaner Co., Ltd.—A meeting of creditors is called for August 25th, at 14, Dale Street, Liverpool, by the liquidator, Mr. A. H. Evans.

The Electrical Supplies Co. (F. J. Allen and E. C. Beman), electrical manufacturers, agents, and wholesale factors, 53, Victoria Street, S.W.—Messrs. F. J. Allen and E. C. Beman have dissolved partnership. Mr. E. C. Beman will attend to debts and carry on the business.

The National Electric Time Co., Ltd.—This company is winding-up voluntarily, with Mr. A. C. Vincent, of 9 and 10, Pancras Lane, E.C., as liquidator; a meeting of creditors is called for August 27th.

Trade Announcements.—Messrs. John Lysaght, Ltd., of Normandy Park Steel Works, Scunthorpe, Lincs., announce that as from the 11th inst. the general management of the works was taken over by Mr. P. Williams in place of Mr. F. W. Cooper.

The London Electric Firm, of Croydon, desire it to be known that they are "carrying on" as usual all their manufactures in lamp-lowering gear, winches, pulleys, wire rope, poles, brackets, &c., all of which are of British manufacture, and large stocks are kept. Searchlights also are entirely made at their works.

Messrs. Fraser & Chalmers, Ltd., of Erith, Kent, have appointed Mr. H. A. Sturgess, The Oak, Motherwell, to represent them in Scotland.

The British Electrical Plant Co., Ltd., of Alloa, N.B., have appointed as their agent in London and South of England Mr. Alan Williams, M.I.E.E., of 9, Queen Victoria Street, E.C., who also represents Messrs. Eckstein, Heap & Co., Ltd., for switchgear, and the Anderston Foundry Co., Ltd., for steam engines, air compressors, &c.

LIGHTING and POWER NOTES.

Arrowthwaite.—Proposed E.L.—The Whitehaven Colliery Co. has accepted the offer of the General Purposes Committee of the Whitehaven T.C. to light 74 houses proposed to be built at Arrowthwaite. On condition that the Committee also lights the streets by electricity, energy is to be supplied in bulk at 4d. per unit, or at 5d. per unit, including meter rent, if supplied to the houses.

Ashton-on-Mersey.—E.L. Charges.—The U.D.C. having urged upon the Altrincham Electric Supply, Ltd., the necessity for a reduction in the price of current, as a flat-rate of 6d. per unit is considered too high, the latter states that the suggested reconstruction of the company is with a view to providing for the extension of the works, and the question of reducing the price of current will then be considered.

Australia.—The Sydney City electrical undertaking gives a supply to 23 suburban municipalities outside the city itself, which owns the undertaking. During 1913 some 32 million units were sold, and the revenue was £285,742. For this year the estimated sales are 42 million units, and the revenue £370,000. The plant capacity of the generating stations is 23,700 KW.

The Sydney Council has adopted the proposal of the E.L. Committee to purchase a coal-bearing property on which to erect an electric generating plant, and tenders are to be invited.—*Australian Mining Standard.*

The City of Newcastle (N.S.W.) has decided to install additional electrical plant, at its power house, at a cost of £6,000.—*Tenders.*

Bradford.—Street Lighting.—The gas lamps on the Laisterdyke to Bankfoot tramway route have been dismantled, and electric lighting, each standard containing five lamps, is being substituted.

Canada.—The B.C. Electric Railway Co. has recently doubled its generating plant capacity, and has now available a total of 105,000 H.P.

A duplicate tunnel has been constructed from Lake Buntzen to the Burrard inlet plant, to which has been added three Doble wheels, each of 14,000 H.P. The auxiliary steam plant has also been increased from 12,000 to 20,000 H.P.

Continental Notes.—Hungary.—The Danube Steamship Co., of Buda-Pesth, has just completed the establishment of a large central electricity station at Uelszog, near Funfkirchen. The municipal authorities of the last-named town have entered into a contract to take their requirements in the way of electricity supply during the next 25 years from the new station, which will also supply current for lighting and power purposes to a number of the small towns and villages in the district.

Spain.—La Sociedad Hidroelectrica Espanola has just secured a concession to put down a plant on the River Cabrie at Enguidanos (Province of Cuenca) for the generation of electrical energy for lighting and power purposes.

Dublin.—New Loan.—The T.C. has entered into an arrangement with the Bank of Ireland to borrow £80,500, sanctioned by the L.G.B. for the development of the electricity works, at 4½ per cent.

Dundalk.—L.G.B. Inquiry.—An inquiry was held last week by an L.G.B. inspector into the application of the R.D.C. for urban powers for lighting certain roads by electricity. The U.D.C. is to supply energy at £2 10s. per lamp per annum.

Durham.—Overhead Wires.—The R.D.C. has consented to overhead wires being used for E.L. purposes at Pittington, Littletown, Cassop and Quarrington.

The Carnforth P.C. has decided to accept the tender of the County of Durham E.P.S. Co. to light the main street of Coxhoe with 50-C.P. electric lamps from dusk till 11 p.m., at 24s. per lamp per annum. The agreement is for five years.

Glasgow.—Electric Police Lamps.—The T.C. has replaced practically the whole of the bull's-eyes formerly supplied to the police force with portable electric lamps, and an additional 1,000 has been ordered for the use of the police in the recently amalgamated areas.

Gravesend.—Free Wiring.—The T.C. has deferred the proposed free wiring scheme in view of the fact that the Association of Municipal Corporations proposes shortly to promote a Bill dealing with the matter.

Great Harwood.—E.L. Order Extended.—The Council's E.L. order expires at the end of this month, and the B. of T. has decided to defer the question of revoking the order for 12 months.

Harrogate.—Supply to Knaresborough.—With reference to the application of the T.C. for permission to supply electricity in the rural district of Knaresborough, the T.C., in reply to a letter from the B. of T., has informed the Board that, in its opinion, the demand for electricity in the Knaresborough area is not sufficient to justify the T.C. applying for a prov. order for the same.

Newport.—Proposed Loan.—On the recommendation of the Electricity Committee, the T.C. has decided to borrow £16,000 for electricity purposes.

New Zealand.—Lake Coleridge Hydro-Electric Plant.—The following are the latest particulars regarding the first of the New Zealand Government bulk supply systems included in its policy of development of the water power resources of the Dominion. Construction is practically completed, and the plant will be in operation before the end of the year (1914). The tunnel, power-house, transformers and transmission lines, are built for an ultimate capacity of 6 × 1,500 KW. Of the generating units 3 × 1,500 KW. are included in the first installation. The head is 485 ft., and the tunnel area 54 sq. ft. From the tunnel

outlet, provision is made for four 52-in. pipes to the power-house, each pipe supplying 2 × 1,500 KW. turbines. The generators are 50-cycle, three-phase units operating at 6,600 volts. The transmission line pressure is 66,000 volts, the transmission line being in duplicate, each consisting of three 7/135 aluminium wires carried on 42-ft. ironbark poles spaced at six chain intervals. The distance of transmission from Lake Coleridge to the Christchurch sub-station is 68 miles. At this point it is transformed down to 11,000 volts, at which pressure it is distributed by overhead and underground primary distributors. Contracts have been entered into with the Christchurch City Council to distribute and retail the power within the city and suburbs. The power will be sold in bulk to the Corporation at £8 13s. 4d. per KW. per annum for the first 300 KW., and £5 per KW. per annum for all over 300 KW., and is to be retailed by the city on the maximum demand system at 6d. and 1d. for light, and 1½d. and ¾d. for power, and for pumping at ½d. per unit. A bulk supply is also to be supplied direct to the Tramway Board, the railway workshops, several mills and factories, and other local bodies, for retail distribution. We are indebted to Mr. Evan Parry, the chief electrical engineer, for the above data.

Ossett.—Overhead Wires Refused.—The Yorkshire Electric Power Co., which has a contract to supply the Low Laithes Colliery with electricity, has been refused permission to use overhead wires by the local authority.

Peterborough.—Sewage Pumping.—The R.D.C. has applied to the T.C. for permission to take a supply of electricity from the Peterborough Traction Co., for sewage pumping.

Rhymney.—Street Lighting.—It was reported to the U.D.C. on August 12th that the manager of the Rhymney Iron Co. (Mr. Rutherford), was going into the matter of the cost of public lighting in the district by electricity, and would submit an early report.

Springhead.—Proposed E.L.—The D.C. has decided to ask the Oldham T.C. to apply for a prov. order to supply electricity in Springhead and Lees.

Taunton.—New Charges.—The T.C. has adopted the following new scale of charges for electricity :—For lighting—Up to 25 units per quarter, 6d. per unit; between 25 and 500, 4½d.; between 500 and 1,000, 4d.; exceeding 1,000, 3d. For cooking and heating :—Up to 50 units per quarter, 2d. per unit; over 50, 1d. For power :—Up to 2,000 units per quarter, 2d. per unit; between 2,000 and 4,000, 1¾d.; over 4,000, 1½d.

Wakefield.—Extension of Supply.—The Electricity Committee has decided to extend the supply of electricity to premises in Aberford Road and Bar Lane, and to apply to the B. of T. for powers to supply electricity in that part of Stanley.

Willesden.—Loan Sanction—The U.D.C. has received sanction from the L.G.B. to borrow the following sums in connection with its electricity undertaking :—Mains, £15,000; services, £5,000; transformers, £1,000; meters and indicators, £3,500; and public lighting, £330, making a total of £24,830.

York.—Overhead Wires.—The Great Ouseburn R.D.C. has given permission for the erection, by the York T.C., of overhead wires for the supply of electricity in Acomb and Poppleton.

TRAMWAY and RAILWAY NOTES.

Australia.—The Victorian Railway Commissioners were recently informed that the contractors for the Newport power station buildings and boiler equipment expected to ship 600 tons of boiler house plant. About 650 tons of steelwork has been received. Four of the six 10,000-KW. turbine sets were recently reported as nearly completed by the makers. The erection of the overhead equipment and transmission cables is being taken in hand, and the sub-station buildings are under construction.

Bradford.—Electric Haulage of Guns.—In connection with the mobilisation of troops, Bradford Corporation tramcars were requisitioned to haul the guns of the 2nd West Riding R.F.A. On Thursday morning, last week, the tramcars hauled the guns from Lister Park to the Driglington terminus—a distance of about six miles. The experiment was entirely satisfactory, and the work was carried out expeditiously.

Continental Notes.—Netherlands.—A Bill has been passed authorising the participation by the State, to the extent of about £8,300, in the capital of a company which is being formed to work an electric railway from Sittard to De Locht. The construction is estimated to cost about £83,300, and the share capital will be subscribed, in addition to the State, by several communes and by the company working the Limburg coal mines.—*Board of Trade Journal.*

Dewsbury-Wakefield.—The Yorkshire (W.D.) Electric Tramways Co. intends commencing a motor-'bus service from Dewsbury to Wakefield.

Walsall.—New Tramcars.—The T.C. has authorised the expenditure by the Tramways Committee of £5,400 for new tramcars, in connection with the Bill for the extension of the tramways now before Parliament.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—Señor Americo Demaria has been authorised by Government decree to extend the telephone line in Viedma, of which he is concessionaire, to the city and district of Carmen de Patagones.—*Review of the River Plate.*

Cut Telegraph Wires.—The telegraph wires between Dover and Folkestone were cut on Tuesday night, the damage being discovered by Boy Scouts. Two employés of the Brighton Railway Co. were remanded on Wednesday for cutting telegraph wires on the line at Battersea; the motive was stated to be revenge.

Farmers and Wireless Telegraphy.—Consideration is being given by the Australian Postal Department to the suggestion that the disadvantages of life in isolated farming districts should be relieved by the installation of small wireless sets, by which communication could be obtained with a central station at the nearest town. The erection of telegraph and telephone lines has been found to be impossible owing to the great expense; even by taking advantages of fences and trees for suspending the wires, the cost is £10 or £12 a mile.

Free Telephone Calls.—The Post Office has issued a notice to the effect that, apart from calls originated over Government circuits, the only calls for which exemption from payment can be claimed are those made by Government servants on urgent Government business.

New Dutch Cables.—The Dutch East Indian Administration has laid the following cables :—Kema (near Merado) to Jorontalo (Celebes); Kema to Ternate; Soerabaja to Balikpapan (Borneo); Singkel to Tapatoean (Sumatra); Tapatoean to Sinabang (Simenloe).

South America.—According to the *Journal Télégraphique*, the Argentine Congress has voted an additional 1,000,000 francs for wireless stations on the coast and between the Argentine and the United States and Europe. Bolivia has also agreed to a contract with the Marconi Co. for the erection of wireless stations at important places in the republic.

The Post Office Telegraph and Telephone Service.—During the first week of the war crisis, the resources of the Post Office engineering staff were taxed to the utmost. Innumerable extra telephone services were demanded by the various authorities concerned, and were put in with a promptitude which reflects the greatest credit upon the department, in spite of the withdrawal of a large number of Reservists. The pressure upon both the telephone and the telegraph services has naturally been very heavy, but by working overtime and cheerfully taking extra duties, the staff have coped successfully with the rush of work. The telephone operators have given a good account of themselves, the efficiency of the service given having been highly appreciated. Last week it was rumoured that, although the Government had declared its intention to maintain business at full volume, the telephone contracts of the Post Office had been cancelled or withdrawn; we are glad to say that the department has wisely decided to proceed on the usual lines, and that telephone manufacturers need have no apprehensions on this score.

Wireless Station Wrecked.—A Government wireless station near Port Arthur (Ontario) has been wrecked. The two men who committed the outrage escaped after some shots had been exchanged.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 9th. Electrical goods, for the Powell Duffryn Steam Coal Co., Ltd.; Stores Manager.

Australia.—Sydney.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

September 14th. Municipal Council. 22,500 yd. of 33,000-volt, three core, paper-insulated, lead-covered cable. Deposit £200. Specification, 10s. 6d., from the City Electrical Engineer; a copy may be seen at the B. of T. Commercial Intelligence Dept., London.

September 30th. Telephone instruments and parts for Postmaster-General. See "Official Notices" to-day.

Adelaide.—Sept. 9th and 23rd. Telephone material, microphones, protectors, &c., switchboards, bells and cells, for the Postmaster-General. See "Official Notices" July 31st and August 7th.

Melbourne.—August 26th. Insulated copper wire, for the Melbourne City Council. See "Official Notices" August 14th.

September 2nd. 6½ tons bare hard drawn copper cable, for the City Council. See "Official Notices" to-day.

September 23rd. 102 electric motors, starters, switchboards and wiring for installing electrical drive at Messrs. Sands & McDougall, printers. Mr. M. C. Coates, consulting engineer.—*Tenders.*

Victorian Railways Department.—October 7th. Motors and switchgear, and motor-driven air compressors for the Ballarat and Bendigo workshops.

Perth.—September 9th. Coin attachments for Postmaster-General. See "Official Notices" August 14th.

Belfast.—August 24th. Corporation. One electric motor tower-wagon. See "Official Notices" July 31st.

Dundee.—August 31st. Corporation. Rotary converters, switchgear. See "Official Notices" to-day.

Harrogate.—The T.C. is to obtain a motor-generator, starting switches, cable, &c., for the Harrogate Kursaal; estimated cost £67.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" July 24th.

London.—L.C.C.—September 8th. Cables, H.T. and L.T., and laying stoneware ducts (tramways). See "Official Notices" August 7th.

September 8th. Reconstruction of motor-generators in the tramway southern sub-stations. See "Official Notices" Aug. 14th.

Manchester.—August 25th. Tramways Committee. Tenders for cast-iron pipes for heating purposes. Particulars from Mr. J. M. McElroy, General Manager, 55, Piccadilly.

Middlesbrough.—September 12th. Corporation. Three electric motor-driven sewage pumps, priming pumps, metering arrangement, pipework, overhead travelling crane. See "Official Notices" August 14th.

New Zealand.—September 30th. Traction battery for the Dunedin City Council. Specifications from the Borough Electrical Engineer.—*N.Z. Shipping and Commerce.*

Oldham.—August 24th. Corporation. Three economisers and three induced-draught fans and motors. See "Official Notices" July 31st.

August 24th. Corporation. Storage battery, reversible booster and switchgear. See "Official Notices" August 7th.

Oldmachar (Aberdeen).—August 24th. Electrical installation at St. Machar's Cathedral, for the Heritors of Oldmachar. Specifications from Messrs. Kelly & Nicol, architects, 367, Union Street, Aberdeen.

Rochdale.—Council. Static transformers for 12 months. Mr. C. C. Atchison, Electricity Works, Dane Street.

South Africa.—August 31st. 22 electric motors for the Salt River workshops, for the Administration of the South African Railway. Copies of specification from the Secretary to the Tender Board, S.A.R., Headquarters Office, Johannesburg.—*Brit. and S.A. Export Gazette.*

Spain.—August 31st. The municipal authorities of El Cerro (Province of Huelva) are inviting tenders for the concession for the electric lighting of the town for a period of 20 years.

Swansea.—August 24th. Corporation. Overhead travelling crane (about 8 tons lifting capacity), for Uplands substation, for the T.C.; Corporation Electricity Works, Strand.

Wigan.—August 24th. Corporation. Tramway rails. Mr. A. T. Gooseman, Borough Engineer, King Street West.

CLOSED.

Aberdeen.—Mr. R. Stuart Pilcher, the general manager of the Corporation Tramways, reported that he had been in communication with the contractors for the new cars recently delivered as to the price at which they would be prepared to supply and equip six additional cars, and had received the following quotations:—

Car bodies.—Brush Electrical Engineering Co., £2,742.
Motors.—Ditto, £1,080.
Electrical equipment.—British Westinghouse Electric & Mfg. Co., £462.

It was recommended that these offers be accepted for six additional cars of the "Pay-as-you-enter" type.

Australia.—The following tenders have been accepted:

Postmaster-General's Department, South Australia:—
Five sections trunk-line switchboard, with equipment, £1,932.—Western Electric Co. (Aus.), Ltd.

External Affairs Department:—
Electric power plant, £184.—Siemens Bros. Dynamo Works, Ltd.

Railway Department, Sydney:—
Specification 484. One 1,000-kw. sub-station unit.—Australian G.E. Co. Two 1,000-kw. ditto.—British Westinghouse Co.

Harbour Trust, Sydney:—
Electric travelling cranes, for Woolloomooloo Bay.—Warburton, Franki, Ltd.

Victoria Railways Department:—
One 35-h.p., D.C. motor, for State coal mine, £131.—Cowlishaw Bros.

Public Works Department:—
Electric lighting installation at the Registrar-General's building, £358.—Acme Electric Co.
75-h.p. motor, £140; 50-h.p. motor, £80.—Australian G.E. Co.
—*Australian Mining Standard.*

Swan Hill (Vic.) Water Trust:—
Electric pumps and equipment, £489.—I.-R., G.-P. and Telegraph Works Co., Ltd.
—*Tenders.*

Bradford.—Mr. Charles Bell has received from the Education Committee the contract for an electric installation for the large hall of the Bradford Technical College, including half-watt lamps and special fittings.

Basingstoke.—The T.C. on August 13th accepted the tender of Messrs. Leader & Co., for wiring the generating station, at £78; and that of Messrs. Milson & Son, for wiring the Town Hall, at £77.

Harrogate.—The T.C. has ordered a fuel economiser from Messrs. Goodbrand & Co.

Southport.—The T.C. has accepted the tender of Messrs. Heenan & Froude for a refuse destructor, at £4,999.

Sunderland.—The T.C. has accepted the following tenders:—

Cables.—British Insulated & Helsby Cables Co., and India-Rubber, Gutta-Percha and Telegraph Works Co.
E.H.T. switch and meter cabinet.—British Thomson-Houston Co.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, August 22nd. Visit "Chronicle" Printing Works, Withy Grove, Manchester.

Association of Mining Electrical Engineers.—Saturday, August 22nd. Visit Wallsend and Hebburn Coal Co.'s Pit.

ELECTROLYTIC REFINING.

By G. BASIL BARHAM, A.M.I.E.E.

Over 50 per cent. of the world's production of copper is refined by electricity, the total weight of electrolytic copper handled annually approximating to half a million tons. It was recognised some time ago that the electro-metallurgist would find it most profitable to give his attention to the electrolytic refining of metals, and in no other branch of the science has such great progress been made, whether viewed from a theoretical or a commercial standpoint.

In connection with copper, not only is the actual refining profitable in itself, but the rough metal contains from 1 to 1½ per cent. of other metals as gold, silver, nickel, lead, antimony, bismuth, and the like. The recovery of these is a source of income which is not to be despised, as will be realised when it is mentioned that the value of the gold and silver alone recovered during the electrical refining of copper in one country is known to exceed £3,500,000 per annum.

When copper is being refined electrolytically a current of suitable strength is passed from an anode of the metal to be dealt with, through a bath of acidulated sulphate of copper, to a convenient cathode, on which the pure metal is deposited. Any gold, silver or other metal present does not pass over, but falls with other impurities to the bottom of the vat from which they are periodically removed. When the refining of bullion is being carried out an action the reverse of that described is carried out; the precious metal is deposited on the cathodes and the copper and other base metals fall to the bottom. In the Siemens and Halske process the solvent for removing the gold in an impure state from the already crushed ore is potassium cyanide, suitably diluted. This is known as the leaching solution from which the gold is ultimately recovered, by means of electrolysis. The anodes are of iron, and in order that the Prussian blue which will be formed shall be retained, they are covered with stout linen bags. The cathodes are of sheet lead, from which the gold is finally recovered in the cupola. Gold obtained in this way may be refined again electrically by using the ingots as anodes. The solution should contain 25 grammes of chloride of gold and 40 cubic centimeters of hydrochloric acid per litre,

the acid being in the purest possible form. The cathodes are thin sheets of pure gold. When the current is caused to flow, gold and platinum pass into the solution in the form of chlorides, and gold is deposited on the cathode plates. Any silver present is formed into silver chloride and forms a slime on the bottom of the vat. It is necessary for the solution to be kept at a temperature of from 60 to 65 degrees whilst the vat is at work.

The practice is for the gold anodes to be about one-sixth of an inch in thickness, and they may contain as much as 15 per cent. of silver. Whilst the refining is going on the current density is gradually decreased, and within 24 hours it will be found that some 80 per cent. of the gold has been deposited on the cathodes, 10 per cent. will still be on the anodes, and the remainder, with the silver and other impurities, will be in the sludge. A point worthy of notice is that in this process only an inch and a quarter separate the anode from the cathode in the vat which is almost invariably of porcelain.

The gold is deposited in a crystalline form, and has to be thoroughly washed before being melted down into ingots. As in the case of silver where the same crystalisation takes place, many methods have been tried to prevent it, as it necessitates frequent removals of the deposit, especially in the case of the latter metal. Also, a greater distance has to be allowed between the anode and cathode than would otherwise be the case. It has been proposed to use gelatine in the electrolyte to prevent the crystals forming, and improved methods of circulating the solution have been devised. By these means some improvements have been effected in the case of silver, and under such conditions it is said that a smooth, homogeneous deposit of the metal can be obtained.

After the gold cathodes are removed the solution is treated chemically in order to remove the platinum, palladium, and other metals present, together with the balance of the gold. This method of electrolytic refining is in use in the United States mint, where the plant consists of seven cells, measuring 13in. by 10½in. by 8in. A current of 100 amperes at 4.5 to 5 volts is passed through the baths, and the plant has a capacity of 5,000 oz. of fine gold per week.

Electrolytic refining of silver is carried out by processes depending on the use of ingots of at least 95 per cent. pure silver. The bath is of nitrate of silver with nitric acid. In order to prevent the loss of slimes, the anodes are enclosed in linen bags. The cathodes are of pure silver arranged as in gold refining, in the form of thin strips. When the current passes, silver is deposited on these in the form of crystals, and the gold and other impurities are collected in the slimes bags. If copper is present in the silver the process becomes more complicated from a chemical point of view, as this metal passes over with the silver after a time. It does not, however, become immediately deposited on the cathodes but is first changed into copper nitrate, contaminating the solution until a certain point of saturation is reached when a deposit of copper commences to form on the cathodes.

The Moebius vat is usually employed for the work where quantities have to be dealt with, although there are at least two other processes which are commercially successful. The Moebius vat in its original form was similar to that is use in copper refining, but in the later patterns the cathode takes the shape of a silver band which passes horizontally through the solution. A scraper is fixed at one end of the vat in such a manner that the band rubs against it as it travels with the result that the silver deposit is removed as soon as it forms, the crystals being delivered into a closed collecting vessel by automatic means. Porous trays are fixed above the travelling cathode and in these the anodes are placed. Consequently these can be conveniently handled, removed, or replaced during the refining without causing any interruption to the process. From particulars given it appears that the plant at this rennery consists of 48 vats, measuring each 14ft. by 16ft. by 7ft. deep. It has a capacity of 24,000 oz. of silver per day, the generating plant supplying 220 amperes at 90 volts. A still larger plant is laid down at the works of the American Smelting and Refining Company, where there are 144 vats requiring a generating plant with an output of 62 kilowatts.

The Moebius system will recover gold when existing in such small quantities as two-tenths of a part per 1,000 parts of silver, and the working costs are as low as 0.062d. per oz. dealt with.

In another system for refining silver by electrolytic methods the anodes are in the shape of thin square slabs. These are covered with linen and are placed horizontally, fixed in a wooden frame, which hangs so that it is just covered by the electrolyte. Slabs of Acheson graphite cut to a uniform thickness of half an inch are laid on the floor of the vat, and upon these the silver crystals are deposited, frequent removals of the deposited metal being necessary. The E.M.F. is 3.8 volts and a current density of 25 amperes per square foot of cathode area, which amounts to 8 square feet in all, is employed. The current consumption works out at 31.5 watt-hours per oz. of silver deposited.

Another metal which is largely being refined by electrolytic methods is aluminium, the method consisting of the electrolysis of alumina in a bath of fused fluorides, the electrodes used being of pure carbon. Difficulties were at first encountered owing to the tendency of the electrolyte to decompose under the action of the current, whilst a further trouble was to render the mineral deposits of alumina sufficiently pure for treatment, but these difficulties have now been successfully overcome.

There are many other metals, as lead and iron, which can be dealt with electrolytically, but sufficient has been said to show that the electro-chemist is able to choose, in the case of impure anodes, which metal shall be deposited on the cathodes and which shall pass over as slimes or sludge.

NOTES.

Educational Notices.—Crystal Palace School of Practical Engineering.—The new course will commence on Wednesday, September 9th. A notice on the matter appears among our advertisements to-day.

University College, University of London.—Faculty of Engineering. The 1914-15 Session begins on Monday, October 5th. Particulars are given in our advertisement pages to-day.

Appointments Vacant.—Leading hand in armature shop, for Bolton Corporation tramways; junior assistant engineer, for Newcastle-upon-Tyne Electric Supply Co. (15s); charge engineer, for Erith U.D.C. (40s. to 50s.); fitter-driver, at Severalls Asylum, Colchester (35s.); cable-jointer and overhead linesman, for Aberdare U.D.C.; charge engineer, for Paisley Corporation; junior assistant electrical engineer (£80), for Oldham Corporation; junior assistants (25s.), for Cleveland and Durham Electric Power, Ltd. See our advertisement pages to-day.

X-Ray Apparatus for War.—On behalf of Lady Chavasse, Dr. Hall Edwards, the well-known Birmingham X-ray specialist, ordered an X-ray apparatus for the Bromsgrove Hospital. This instrument her ladyship has now placed at the disposal of Dr. Hall Edwards for use in the war. Two other sets of apparatus are also at the disposal of the doctor.—*Birmingham Daily Post.*

A "Sewage" Gas Engine.—A gas engine at the Parramatta, N.S.W., sewage pumping station is operating satisfactorily on sewer gas generated in the septic tanks. Mr. Walshaw, the engineer, who is responsible for the idea, expresses himself as satisfied that there is a sufficient supply of gas to justify the installation of electric generators.—*Commonwealth Engineer.*

British Association.—It appears from a paragraph in the *Times*, that the British Association New Zealand meeting has been cancelled, and that members will return home after visiting Brisbane and Melbourne.

Electrical Competition with Germany and Austria-Hungary in Neutral Markets.—Since our "War Items" pages went to press we have received from the Board of Trade Commercial Intelligence Department a document of some 48 pages giving from official sources a vast quantity of statistical and general information respecting the exports of electrical appliances and apparatus from these countries in recent years. It discusses the principal markets in which our enemies have been electrically active, and quotes extracts from reports by British Trade Commissioners in the leading Colonies, and a host of Consuls bearing on their progress. Much of the material appearing in this publication has, of course, already been published in the pages of the ELECTRICAL REVIEW, but we commend the present valuable collection of information to the prompt attention of all British firms who are interested in the movement for securing to this country Germany's electrical export trade.

Inquiries.—"Electricus" asks for the names of manufacturers of electrical apparatus for applying to mechanical milking machines for dairy purposes, and any other information on the matter.

Helium in France.—According to communications made to the French Académie des Sciences by MM. Mouren and Lepage, quite a number of French natural springs contain considerable quantities of helium. In many springs in the Côte d'Or helium is present to an extent of 10 per cent., the other gases being nitrogen and argon, crypton, xenon and neon. The Carnot spring in Santenaz yields 17·845 litres of helium yearly.

Electric Vehicles and the War.—Writing on the sudden requisition of horses and motor vans for military purposes, and the fears of a shortage of petrol, our contemporary, *Motor Traction*, mentions that there has been something like a boom in Edison battery vehicles. The experience gained by Messrs. J. Lyons & Co. with the 2-ton electric van recently purchased has been so satisfactory, that they placed an order with Edison Accumulators, Ltd., for all the vehicles of whatever kind they could spare, and seven ranging in capacity from 5 tons to ½ ton, were ordered for immediate delivery. Another urgent order was received from the Great Western and Metropolitan Dairies, Ltd., who recently acquired a 2-ton Edison electric, for two further similar vehicles. Other orders were also received, and we gather that in one day every Edison "electric" that could be made ready for immediate service was disposed of, including some which were brought back from a demonstration tour. We may add that this sudden accession of popularity of the electric vehicle in a time of stress is due largely to its inherent advantages. An increase in the price of electrical energy is unlikely, while the price of motor spirit is at least uncertain; the electric requires, on the whole, less skilled attention than either petrol or steam-driven vehicles, and repairs are a much simpler matter. Moreover, looked at solely from a commercial point of view, the so-called mileage limitation of the electric—which covers sufficient miles for the majority of town businesses—is an all-important advantage, as such vehicles are unlikely to be requisitioned for other than local use by the military authorities. Certain trades must be maintained in any emergency, and it is probable that the use of the electric vehicle in such cases, while preventing wholesale dislocation of business, would induce the military authorities to provide their own transport equipment on a more generous scale than hitherto.

Wayleave Rentals.—The electrical engineer of a Colonial electricity supply undertaking sends us a copy of an account rendered by a local municipality to his Council, which he regards as the most atrocious thing he has ever seen in the way of rental for overhead mains. All the runs are short. Rent charges on electric cables, year 1914:—

Bennett & Son	£0	5	0
Imperial Pictures	0	5	0
Marquett's, Ltd.	0	5	0
Howard	0	5	0
Mullens & Co	0	5	0
N.S.W.A. Water Co.	0	5	0
McNaughton & Son	0	5	0
Healey	0	5	0
Main line	1	2	6
	£3	2	6

Electric Lamp Development.—In the *Electrical World* of July 11th Mr. E. H. Waldo, after referring to the fact that Sawyer and others were working with nitrogen and other gases in lamp bulbs about 1880, pointed out that work had been done much earlier along the same line. One of the first investigators to produce an incandescent lamp was W. R. Grove, the inventor of the "Grove" cell. Faraday had proposed "inclosing wire in a tube for the purpose of being able to ignite a longer portion of it." In 1840 and 1841 Grove was using for lighting his laboratory an incandescent lamp which embodied some of the principles of our latest lamps. He used a metallic filament.

"Not knowing how to reduce tungsten powder to a wire, he used platinum as the best metal available for a filament, and arranged the wire in the form of a helix, the spirals of which were brought as close together as possible, 'as each aids by its heat that of its neighbour, or rather diminishes the cooling effect of the gaseous atmosphere. The wire should not be too fine, as it would not then become fully ignited. The helix form offers the advantages that, the cooling effect being lessened, a much longer wire can be ignited by the same battery. By this increased length of wire, the battery fuel is economised, while the greater light is afforded. By the increased heat the resistance is still further increased and the consumption still further diminished.' Here we see not only the metallic helix, but also the beginning of an attempt for a high-resistance lamp later worked on by Edison.

"Grove's lamp was made by inverting over water a beaker within which the filament was placed, the insulated leading-in wires dipping under the edge of the beaker. Grove realised, however, that the result could be accomplished better by placing the wire in a glass globe into which the conducting wires were sealed.

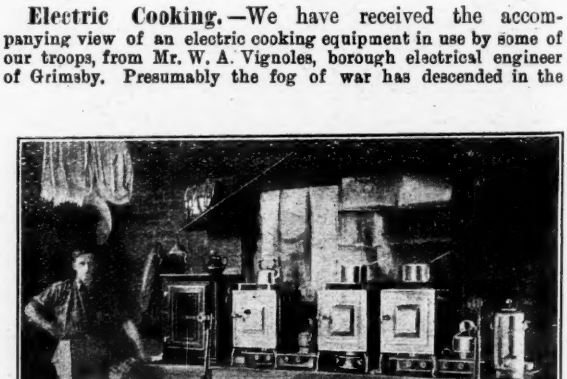
"The form of the latest nitrogen-filled tungsten lamp was even more closely approximated than this, for, realising the effect of different gases on radiant heat, Grove tried filling his lamp at approximately atmospheric pressure with a number of different gases, hydrogen, carbon dioxide, oxygen and nitrogen. As nearly as he could observe the candle-power was the same in oxygen, nitrogen and air, using in each case the same battery, which consisted of two or three pairs of Grove cells. He measured roughly the power consumed, and discovered that with nitrogen and air less power was used than with the other gases; hydrogen and carbon dioxide, besides taking considerably more electrical power, gave very much lower candle-powers.

"We see then that more than 70 years ago very many of the ideas contained in the latest lamp development had been tried and noted. Very soon after this, Starr patented his carbon-filament vacuum lamp. The work on incandescent lamps since that time has been largely a repetition of the earlier attempts, alternating between metallic and carbon filaments and between vacua and nitrogen atmospheres.

"Another type of lamp which has come into use comparatively recently, the mercury-vapour lamp, was employed as early as 1861, when signals were flashed from Fort Washington to the White House, using the lighthouse lantern with the mercury-vapour lamp as a source of light. And in 1862 Geissler tubes (vacuum-tube lighting) were proposed for mine illumination."

Lack of Lecturers.—At a meeting of the Newcastle-on-Tyne Education Committee on the 12th inst., the Lord Mayor (Mr. Johnstone Wallace), as chairman of the Rutherford College Sub-Committee, presented the report, which contained the following recommendation:—That owing to the lack of suitable applications for the post of Lecturer in Electrical Engineering, this appointment be not made at present, but that it be readvertised at a commencing salary of £180, instead of £160 as previously offered. The Lord Mayor said the class of man responding to the last advertisement was not just the type of man they required, and they decided to readvertise at a slightly higher figure in the hope that they might get more suitable applicants. This was agreed to.

Electric Cooking.—We have received the accompanying view of an electric cooking equipment in use by some of our troops, from Mr. W. A. Vignoles, borough electrical engineer of Grimsby. Presumably the fog of war has descended in the Grimsby area; at any rate, we are unable to give any details, official or otherwise, but our readers can, no doubt, be trusted to recognise certain well-known electrical cooking apparatus in the view.



ELECTRIC COOKING FOR TROOPS AT GRIMSBY.

The Edison & Swan City Showrooms.—In our last issue on page 247, in describing the Edison & Swan United Electric Light Co.'s new City headquarters, in the last paragraph we inadvertently referred to them as the new Victoria Street premises; this should, of course, have been "Queen Victoria Street premises," as mentioned earlier in the article.

Panama Canal Opened.—Reuter reports that the Panama Canal Zone celebrated the opening of the Canal on August 15th. The first vessel passed through the Gatun locks in 70 minutes.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. R. V. WEEKE, manager of the Chichester Electric Supply Co., was married on Saturday last to Miss Kate Farr.

MR. CHARLES FURNESS, Blackpool's electrical engineer, left on August 12th, for Eysden, Holland, near the Belgian border, to bring home his 14-year old daughter, who, with another girl, was at a convent school. Mrs. Furness was delighted, on August 13th, to report a telegram from her husband announcing that he had arrived at Folkestone, along with their daughter and other children, safely from Holland.

The Swansea Council on Friday decided to advertise for a borough electrical engineer, at a salary of £500 per annum. Mr. C. A. L. Pruesmann has held the position for the past 10 years, but is now relinquishing the post.

Tramway Officials.—In view of the war, proposals made at Ashton to increase the salary of MR. ERNEST HOLT, tramways manager, by £50 per annum, and the salary of MR. APPELBEE, electrical engineer, by £50 now, and a further £50 next year, have been withdrawn.

General.—The marriage was solemnised at Christ Church, Blackburn, last week, of MR. ALBERT ISHERWOOD, electrical engineer, and Miss Elsie G. Senior.

At Christ Church, Henley, on August 11th, the marriage took place of MR. FRANK SWINDLER, of the electrical staff of Messrs. Whipp & Bourne, of Castleton, Rochdale, and Miss Jane Soothill.

MR. J. G. BALSILLIE, Commonwealth engineer for radio-telegraphy, has notified the Postmaster-General that he does not intend to offer himself for reappointment after his three years' engagement, which expires in September next, as his private practice will require the whole of his attention.—*Commonwealth Engineer.*

MR. S. G. SMITH, late of the staff of Messrs. Cole, Marchant and Morley, of Bradford, has been appointed assistant foundry superintendent to the British Westinghouse Co, Ltd., of Trafford Park, Manchester.

Golfers in the electrical world and members of the Electro-Harmonic Society will be interested in the current issue of *The Secretary*, which contains a full-page photograph of Mr. W. E. Lane, the first holder of the Morrison McLeod challenge cup presented to the Chartered Secretaries' Golfing Societies.

Obituary.—The death took place last week, at the Doncaster Military Depôt, of MR. EDGAR ARMITAGE (48), of Staincliffe. The deceased had been employed by the Yorkshire (Heavy Woollen District) Electric Tramways Co., Ltd., ever since that company commenced operations. He went with the Dewsbury Detachment of the 4th King's Own Yorkshire Light Infantry to Doncaster, in response to the mobilisation orders, but on parade on the day following his arrival at Doncaster, Mr. Armitage did not feel well. He was taken to hospital, and died later in the day.

The death is recorded, at the age of 51 years, of MR. CHARLES CORDINGLEY, proprietor and editor of publications connected with the motor trades, and organiser, many years ago, of motor-car and other exhibitions at the Agricultural Hall.

Indian Engineering states that the death has occurred of MR. D. S. CLAYTON, manager of the Electric Telephone Co. in Madras, who arrived there two years ago from Calcutta.

NEW COMPANIES REGISTERED.

Universal Electric Canoe Co., Ltd. (137,387).—This company was registered on August 8th, with a capital of £1,000 in 990 ordinary shares of £1 each and 200 deferred shares of 1s. each, to carry on the business of electric canoe, launch and boat builders, manufacturers of propelled canoes, boats, ships and vessels, &c. The subscribers (with one share each) are:—E. Dunkels, Woodhurst, Maidenhead, Berks., gentleman; A. Wilder, 62, Market Street, Maidenhead, Berks., boat builder; J. M. Wilder, Glen Roy, Ray Mead Road, Maidenhead, Berks, boat builder; H. J. Wilder, Glen Roy, Ray Mead Road, Maidenhead, Berks., boat builder. Private company. The number of directors is not to be less than two or more than five; the first are E. Dunkels and A. Wilder (both permanent); qualification, £3. Registered office, 1, Park Street, Maidenhead.

E. M. Evans & Son, Ltd. (137,390).—This company was registered on August 12th with a capital of £3,000 in £1 shares (1,000 6 per cent. cumulative preference), to take over the business of an electrical engineer and contractor carried on by J. H. Evans at 1 and 5, Lever Street, Manchester, as E. M. Evans & Co. The subscribers (with one share each) are:—J. H. Evans, Chetwynd, Woodford, Cheshire, electrical engineer and contractor; U. Tinker, 19, Mornington Street, Chorlton-on-Medlock, Manchester, cashier. Private company. J. H. Evans is permanent governing director, subject to holding £750 of the shares allotted to him under purchase of agreement. Registered office, 1, Lever Street, Piccadilly, W.

J. Davis & Co. (Southampton), Ltd. (137,379).—This company was registered on August 11th, with a capital of £2,000 in £1 shares, to carry on the business of electrical and general engineers and contractors, suppliers of electricity, manufacturers of and dealers in railway, tramway, magnetic, galvanic and other apparatus, &c., and to adopt an agreement with T. Davis. The subscribers (with one share each) are:—F. W. Griffith, 19, Elgin Avenue, W., clerk; T. Davis, 71, Bedford Place, Southampton, electrical and mechanical engineer. Private company. The number of directors is not to be less than two or more than six; T. Davis is permanent governing director, subject to holding 666 shares. Registered office, 71, Bedford Place, Southampton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Newcastle and District Electric Lighting Co., Ltd.—Particulars of £30,000 debentures, created July 31st, 1914, and secured by trust deed of even date filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Certain specific plant and machinery, benefit of certain obligations, undertaking and property (other than specifically charged premises and uncalled capital), and all money resulting from compulsory sale under Provisional Order or Act of Parliament. Trustees: B. C. Browne, jun., and T. W. Thompson.

Corona Lamp Works, Ltd.—Issue on July 29th, 1914, of £5,600, part of a series of which particulars have already been filed.

Venner Time Switches, Ltd.—A memorandum of satisfaction to the extent of £500 on July 18th, 1914, of debentures dated July 10th, 1911, securing £5,000 has been filed (amount outstanding £3,500).

CITY NOTES.

Tyneside Tramways and Tramroads Co.

AT the annual general meeting of the above company, the CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 258), stated that the receipts were £15,553, or £986 more than in the corresponding period of last year. At the meeting for the corresponding half-year he had to report an increase of £1,049, so that the present increase was not quite so good. The £986 was made up of £406 on ordinary traffic, £42 workmen's traffic, and £537 for other traffic. The actual receipts were 10·48d. per car-mile, against 9·94d. in the corresponding half-year, and 9·26d. for the half-year before. The costs amounted to 6·58d. per car-mile, as against 6·27d. per car-mile, an increase of ·3d. per car-mile. This latter increased expenditure was almost entirely accounted for by the gradually increasing amount which they spent for repairs and maintenance, an expenditure they were charging to revenue. They were also providing a reserve fund, and proposed to add to it £1,430. The reserve now stood at £17,526, against £14,538 at the corresponding period of last year. The directors had decided that as it was an entirely cash business they were engaged in, and as they had a large number of small shareholders, they did not think it right to change the date of the payment of the dividend. It was their duty to endeavour to carry on the business of the country as nearly as possible on ordinary lines. In conclusion, the chairman said the expenses incurred in safeguarding the company in regard to the Newcastle-on-Tyne Parliamentary Bill had been provided for and taken off the profits of the last half-year.

MR. G. E. HENDERSON, vice-chairman, seconded, and the report was adopted.

The dividends having been formally approved, the meeting terminated.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books are closed from August 18th to 31st for the preparation of warrants for interim dividends payable as usual on 31st inst. in respect of the 7 per cent. cumulative first preference and 6 per cent. cumulative second preference shares.

Manaos Tramways and Light Co., Ltd.—The directors report that for the year ended April 30th the receipts from the tramways were £87,028, as against £106·148 for the previous year, and from the lighting department £44,395, as against £44,148. The results are not considered unsatisfactory in view of the depression prevailing in Brazil generally, and particularly in the Amazon. The State is heavily in arrears in payment for the street lighting. The Federal and the Municipal Governments' current accounts are also seriously in arrear, but other collections have been well maintained. Under the circumstances the directors cannot see their way to recommend the payment of a dividend. To the balance of £14,426 remaining after payment of debenture interest and sinking fund should be added the amount of £3,435 brought forward, making a total of £17,861. This the directors recommend should be dealt with thus:—Transfer to contingencies reserve, £8,000; transfer to renewals reserve, £6,000; leaving to be carried forward £3,861.

Tyneside Electrical Development Co., Ltd.—The directors have declared an interim dividend of 5 per cent., less income-tax, payable on August 31st.

Hadfields, Ltd.—An interim dividend of 1s. per share, tax free, on the ordinary shares, has been declared for the half-year ended June 30th.

Hydro-Electric Power & Metallurgical Co., Ltd.—At the meeting of first mortgage debenture-holders held on Wednesday, the resolution referred to on page 258 of our last issue was adopted.

STOCKS AND SHARES.

Tuesday Evening.

With the Stock Exchange closed and Consols at 70, to say nothing of a moratorium which possibly may be extended beyond its due date of September 4th, it may be supposed that affairs in the neighbourhood of Throgmorton Street are none too flourishing. Members find their occupation gone. A great number are at York House, working voluntarily for the Prince of Wales's National Fund. Others have gone to the front, and some still stroll up and down the street, to the admiration of all who are not themselves in khaki. A few are engaged in buying horses for the Government, and a much larger body adopt the sensible course of rusticating in the country on as little as they can per diem. The question of reopening the markets remains fraught with danger, not to the Stock Exchange alone, but to the community at large; and the House authorities have to take into consideration many minor chains of circumstance of which the outsider can have little conception.

The main difficulty concerns itself with the stocks open on Continental account with London houses. The French and German interests cannot be expected to pay, and, therefore, any resumption of open markets would set free a very torrent of selling from those in whose hands the stock now rests. It is quite problematical to what extent bankers are prepared to continue existing loans, much less to negotiate fresh money. Good news from the theatre of war, if it held out reasonable hope of peace ensuing, would afford the most powerful stimulus that could be desired by those who want the Stock Exchange to re-open, if only from the point of view of knowing what their securities are worth. Until this comes, it is difficult to see how markets can be started, except under conditions which, as already hinted, might precipitate panic.

Business, on a very limited scale indeed, is being carried on; and we know of one firm of brokers, for instance, whose expenses average £200 a week, who have taken the lordly sum of £3 15s. in commission since the Stock Exchange closed on July 31st—the said expenses being reduced by £2 or £3 a week through money saved on postages and stationery. The collapse followed six months of hard times for investors and stock markets, so that, when business was suspended, many leading quotations had already undergone severe shrinkage before the beginning of the war.

It is our annual practice at this season to set out short comparative tables of the fluctuations which representative electrical stocks and shares have experienced since New Year's Day; and, although the House is closed, there is an exceptional interest attaching to the process now, inasmuch as quite a large percentage of the prices in electrical stocks and shares actually show rises, compared with seven months ago, as the following examples illustrate:—

Stock or share.	Dec. 31st, 1913.	July 30th, 1914.	Rise or fall.
Metropolitan	46	31½	— 14½
Metropolitan District	32	19	— 13
Central London Deferred	62½	42½	— 20
British Insulated	8	10½	+ 2½
British Westinghouse Pref.	1½	1 13/16	+ 3/16
Callender's	11	12	+ 1
Henley's	13	15	+ 2
Babcock & Wilcox	2 15/16	2 3/4	— 3/16
City of London Ordinary	17	16	+ 1
County	12	12	..
Kensington	7 7/8	7½	— 3/8
St. James'	8 3/8	9 5/8	+ 1/4
Westminster	8 3/4	8 5/8	+ 1/8
Brazil Traction	83½	58	— 25½
Mexican Light and Power	41	45½	+ 3½
Shawinigan	135	125	— 10
Mexico Trams	66½	62½	— 4
British Electric Traction 7 per cent.	53¾	55¾	+ 2
Anglo-American Telegraph Pref.	10 3/4	108	+ 2½
Eastern Extension	12½	12 3/8	+ 3/8
Eastern Telegraph	125½	130½	+ 5
West India and Panama	2⅜	1½	— 1½
Marconi	3 1/16	1 5/16	— 1¾
Globe Telegraph	10½	11¼	+ ¾

It seems extraordinary that, out of the two dozen securities which we took purely at random, save in the way of drawing examples from five principal sections, more than half should have rises to their credit. But of course it is only fair to add that the current quotations are largely nominal. Buyers could no doubt get on in nearly every case at the above figures, or possibly a little less; though what sellers would be able to get for the same shares it would be difficult to say.

As with other matters in which people were a little demoralised upon the first shock of the war, the question of deferring dividend payments has been settled by most companies agreeing to distribute their profits in the usual way. Delay has occurred in certain cases, and in a comparative few the money is to be withheld for the time being. But the contention advanced here last week, that great hardship would be inflicted upon numbers of relatively small investors were dividends not to be paid, is now so generally recognised that the public can reckon upon getting its regular dividends this autumn, in spite of the war.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, only nominal.

Wednesday, August 19th.

CHEMICALS, &c.		Latest Price.	Fortnight's inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a " Nitric	"	..	..
a " Oxalic	per lb.	..	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	..	..
a Ammonia, Muriate (large crystal)	per ton	..	..
a Bleaching powder	"	£10	£3 15 inc.
a Bisulphide of Carbon	"	..	..
a Borax	"	..	..
a Copper Sulphate	"	..	..
a Lead, Nitrate	"	..	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
e Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %)	per ton	..	..
a " Chlorate	per lb.	7d.	3½d. inc.
a " Perchlorate	"	9d.	5½d. inc.
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	..	..
a Shellac	per cwt.	..	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	"	..	..
a " Recovered	"	..	..
a " Lump	"	..	..
a Soda, Caustic (white 70/73 %)	"	..	..
a " Chlorate	per lb.	7d.	8½d inc.
a " Crystals	per ton	..	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£86	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£107 6 8	..
b " Sheet, in ton lots	"	£112	..
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8¼d.	1⅛d. inc.
c " Tube (brazed)	"	10d.	¼d. inc.
c " " (solid drawn)	"	8¼d.	1¼d. inc.
c " Wire, basis	"	8⅝d.	1⅛d. inc.
c Copper Tubes (brazed)	"	10d.	⅛d. inc.
c " " (solid drawn)	"	10d.	⅛d. inc.
g " Bars (best selected)	per ton	Nom.	..
g " Sheet	"	Nom.	..
g " Rod	"	Nom.	..
d " (Electrolytic) Bars	"	£72	£9 10 inc.
d " " Sheets	"	£90	£8 inc.
d " " Rods	"	£78	£9 10 inc.
d " " H.C. Wire	per lb.	9⅞d.	1/16d. inc.
f Ebonite Rod	"	4/6	..
f " Sheet	"	4/-	..
n German Silver Wire	"	1/7	1d. inc.
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3 1	1⅛d. inc.
i Iron Pig (Cleveland warrants)	per ton	52/11	1/7 inc.
l " Wire, galv. No. 8, P.O. qual.	"	£16	£2 inc.
g Lead, English Pig	"	Nom.	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	Nom.	..
c Mica (in original cases) small	per lb.	4d. to 2/6	..
e " " " medium	"	2/- to 5/-	..
e " " " large	"	6/6 to 10,6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/0½ to 1/2	..
p " " rolled strip & sheet	"	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	Nom.	..
g Tin, Block (English)	"	Nom.	..
n " Wire, Nos. 1 to 16	per lb.	2/3	..
p White Anti-friction Metals	per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edwa d Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, free of income-tax, for the half-year ending June 30th last, both payable September 1st.

Bell's United Asbestos Co., Ltd.—A financial daily states that the directors, owing to the present financial situation, have postponed the payment of an interim dividend on the ordinary shares. The half-year's trade has been satisfactory, and with the resumption of normal conditions, a distribution may be expected.

Bank Rate.—The Bank Rate is 5 per cent., to which it was reduced on August 8th.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1914.

In contrast with the returns for the preceding month, the July figures for electrical exports and imports reached values well in excess of the average figures for the first half of the year.

The exports of British material were valued at £564,291, which compares with £462,231 in the previous month; the increase was, however, mainly due to a large telegraphic export to British West Africa, which increased the June telegraphic total of £72,355 to £175,287 in July. Machinery exports also increased by roughly £12,000, but in other directions the returns show some falling off, notably in exports of goods and telephonic material, and, to a less degree, cable exports.

The imports, valued at £291,244, nearly reached the highest recorded total this year, and compare with £261,770, the value for June; amongst the sections showing increases were the machinery, cable, telegraphic and telephonic imports. The re-exports only reached a total of £19,478, the lowest figure recorded this year. Our best customer during the month was British West Africa, owing to the circumstance mentioned, and otherwise trade with India, Japan, Argentina, Canada and Australia attained respectable proportions.

In the light of recent events, it is not surprising that German imports into this country jumped up by some £30,000 to £168,250 in July, before the declaration of War; Belgian imports also doubled, while the American figures show a decrease.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	843	720	171	...	326	121	18,111	908	...	88	395	5,658	27,341
Germany	3,631	1,091	37	...	283	8	6,550	800	...	282	26	111	12,819
Netherlands, Java and Dutch Indies ...	670	945	207	...	32	105	1,246	335	11	...	48	253	3,852
Belgium	791	144	37	19	116	29	11,447	4	390	...	4,092	257	17,326
France	292	...	2,795	...	39	25	10,665	16	...	159	147	3,183	17,321
Portugal	800	69	19	12	...	...	486	...	17	...	594	56	2,053
Spain, Canary Isles and Spanish N. Africa...	898	426	53	...	...	999	3,385	...	394	91	210	...	6,456
Switzerland, Italy and Austria-Hungary ...	1,286	140	271	...	58	513	3,029	22	10	331	...	2,353	8,013
Greece, Roumania, Turkey and Bulgaria ...	693	99	481	...	...	...	500	...	...	25	642	1,715	4,155
Channel Isles, Gibraltar, Malta and Cyprus...	44	47	12	12	...	46	...	...	7	10	35	122	335
U.S.A., Philippines and Cuba	202	...	920	236	...	15	1,067	...	...	...	40	313	2,793
Canada and Newfoundland	403	1,429	967	673	...	139	10,727	3,074	1,830	4	397	19,907	39,550
British West Indies and British Guiana ...	173	77	410	139	...	10	196	...	46	15	...	154	1,220
Mexico and Central America	22	...	44	...	...	...	214	...	...	38	...	...	318
Peru and Uruguay	363	...	...	33	...	...	3,423	207	100	42	325	35	4,528
Chile	134	96	7	61	...	...	822	975	71	...	...	650	2,816
Brazil	530	341	445	67	20	81	10,484	98	...	...	99	732	12,897
Argentina	7,293	8,239	4,544	598	514	3,866	11,198	323	2,277	66	850	5,884	45,652
Colombia, Venezuela, Ecuador and Bolivia...	...	...	...	...	...	...	13	...	...	...	...	411	424
Egypt, Tunis and Morocco	116	258	110	176	...	5	1,017	41	1,607	...	...	316	3,646
British West Africa	75	426	101	71	...	21	129	45	107	...	89	95,524	96,588
Rhodesia, O.R.C. and Transvaal	1,139	26	512	815	45	14	2,506	170	149	18	54	516	5,964
Cape of Good Hope	2,654	2,418	95	638	72	299	5,007	2,328	573	...	1,678	219	15,981
Natal	822	2,857	116	259	117	6	2,173	...	181	24	418	41	7,014
Zanzibar, Brit. E. Africa, Mauritius & Aden	555	375	438	86	...	32	343	61	167	12	36	213	2,348
Azores, Madeira and Portuguese Africa ...	91	479	39	34	...	50	1,089	270	644	...	48	77	2,821
French African Colonies and Madagascar...	9	...	59	...	...	...	...	...	...	...	...	...	68
China and Siam	1,426	971	478	...	...	721	2,059	97	199	15	173	...	6,139
Japan and Korea	480	650	...	4	...	298	15,682	...	366	20	775	28,399	46,674
India	4,885	17,335	3,611	1,613	467	357	25,945	10,558	4,517	334	5,336	3,768	78,726
Ceylon	507	152	110	99	44	46	287	100	284	...	48	83	1,760
Straits Settlements, Fed. Malay States and Sarawak	1,637	1,168	494	31	75	83	7,146	102	757	8	826	1,162	13,489
Hong Kong	610	390	146	47	...	168	1,017	...	1,072	...	...	454	3,904
West Australia	276	4,155	120	276	14	...	1,411	...	19	...	645	677	7,593
South Australia	295	399	154	76	26	179	231	4	16	...	...	304	1,684
Victoria	1,138	7,199	573	1,574	93	1,583	3,982	220	543	...	676	269	17,850
New South Wales	1,588	3,986	1,441	1,269	607	268	7,348	995	942	56	2,387	755	21,642
Queensland	395	100	72	258	...	...	1,293	...	23	39	1,766	62	4,008
Tasmania	...	...	...	10	...	...	75	...	...	...	14	100	199
New Zealand and Fiji Islands	744	2,962	694	803	268	...	4,498	776	1,250	...	3,805	524	16,324
Total, £	38,510	60,169	20,783	9,989	3,216	10,087	176,801	22,529	18,569	1,677	26,674	175,287	564,291

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	570	...	...	...	...	...	3,332	18	2,323	...	7,662	13,905
Germany	4,653	23,955	5,038	10,188	5,922	2,060	95,775	...	5,043	6,708	8,908	168,250
Holland...	10	25	...	213	683	...	5	...	...	184	...	1,120
Belgium	1,125	12,262	...	178	78	26	5,980	50	128	30	2,435	22,292
France	581	107	311	134	290	878	161	105	2,455	2,845	604	8,471
Switzerland	535	7,113	...	40	1,055	6,981	...	...	213	...	203	16,140
Italy	57	5,580	...	...	...	...	22	...	...	...	596	6,235
Austria-Hungary	16	2,457	...	245	6	347	...	107	...	...	...	3,178
United States	4,391	1,189	2,235	...	31	91	11,941	27,578	1,095	38	1,986	50,575
Total, £	11,918	52,688	7,584	10,998	8,065	10,383	117,216	27,858	11,257	9,805	22,394	290,166

Additional imports: Spain: Electrical machinery, £50; carbons, £646. Turkey: Electrical machinery, £10. Canada: Electrical goods, £142; fittings, £30; arc lamps, £5; meters, £18; machinery, £177.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	10,663	815	...	508	246	...	5,157	...	808	277	1,004	19,478

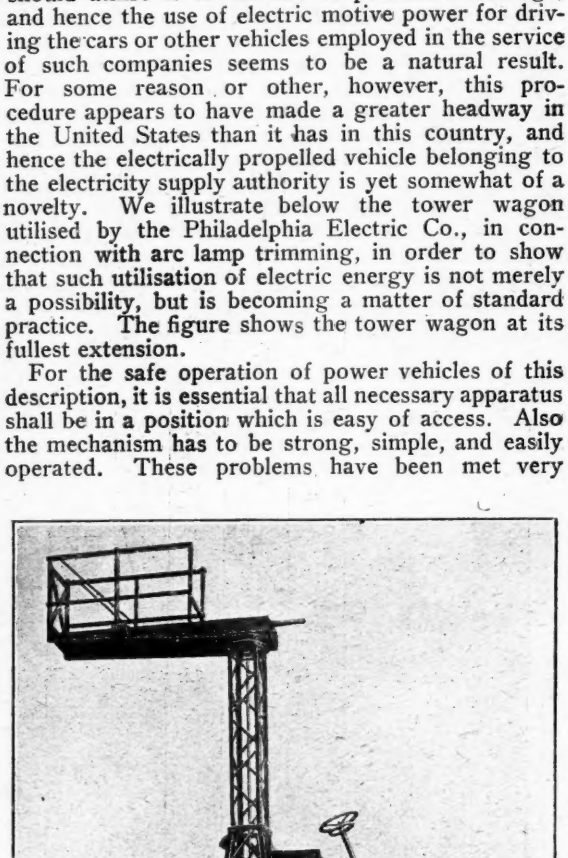
TOTAL EXPORTS: £564,291 TOTAL RE-EXPORTS: £19,478 TOTAL IMPORTS: £291,244

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ELECTRICALLY-PROPELLED TOWER WAGONS.

It seems fairly obvious that if an electric light or power company has faith in its own commodity, it should utilise it to the fullest possible advantage, and hence the use of electric motive power for driving the cars or other vehicles employed in the service of such companies seems to be a natural result. For some reason or other, however, this procedure appears to have made a greater headway in the United States than it has in this country, and hence the electrically propelled vehicle belonging to the electricity supply authority is yet somewhat of a novelty. We illustrate below the tower wagon utilised by the Philadelphia Electric Co., in connection with arc lamp trimming, in order to show that such utilisation of electric energy is not merely a possibility, but is becoming a matter of standard practice. The figure shows the tower wagon at its fullest extension.

For the safe operation of power vehicles of this description, it is essential that all necessary apparatus shall be in a position which is easy of access. Also the mechanism has to be strong, simple, and easily operated. These problems have been met very



American Electric Tower-Wagon for Arc Lamp Trimming.

satisfactorily by the Commercial Truck Co. of America, whose works are at Philadelphia, this company having adopted, in preference to other types, a steering wheel mounted on an inclined column with a control wheel immediately below, as shown in the illustration. In order that the car may be equally well controlled by a man on the upper platform, the extension of the steering rod is carried upward and backward to the top position, a duplicate steering and control wheel being mounted in that position. The controller is of the continuous torque type mounted on the chassis and forming the base of the steering column. Its position places it in the most desirable place for inspection, leaving the space under the seat available for loading and other purposes. The controller gives three speeds forward and two reverse, without breaking circuit between points, making the acceleration smooth and without sudden jerks or strains on the gearing and tires. The steering gear is mounted on the frame immediately below the controller, the steering shaft passing through the latter.

The drive or reduction gear from the motor to the rear wheels is the Hindley type worm and gear. By the use of this type of gear, it is possible to transmit the power from the motor to the rear wheels by a single reduction, thus avoiding complication and the large number of parts necessary where double reduction is employed. The rear wheels are mounted on taper roller bearings entirely independent of the driving mechanism, and are driven by floating shafts engaging the outer end of the wheel hub, the inner ends of which slip by means of squared ends into the hubs of bevel differential gears. The whole mechanism is immersed in oil, giving a minimum of wear, and noiseless operation.

The rear construction, consisting of the motor, gear casing, axle housing and gear wheels, with the gearing and driving shafts, constitutes a complete power equipment which is readily removable for inspection and repairs. All parts of the driving unit are set in a fixed and unalterable relation to each other. Ample braking capacity is provided in the internal expanding brakes. The brake is controlled by a foot-lever, and is reinforced by an electric emergency brake, and either of these is ample to hold the vehicle under any condition. The battery used is of an improved lead type or Edison type giving 85 volts, the capacity being adjusted to suit the service requirements. In the 500-pound wagon it is of 16 amperes' capacity, while in the 1,000-pound wagon it is rated at 22 amperes. The rated speed is 15 miles per hour, and the mileage is 40 to 60, depending on the battery equipment. It is to be hoped that with the extending use of electric light and power in this country, we shall shortly see more of these vehicles in ordinary use upon our roads, and it will be a good thing if the electricity supply authorities of Great Britain give a decided lead in this direction.

REVIEWS.

Practical uses of the Wave Meter in Wireless Telegraphy. By J. O. Mauborgne. London: Hill Publishing Co. Price 4/2 net.

This useful and interesting little work has for author a first lieutenant in the U.S. Army who was formerly an instructor at one of the U.S. Army Signal Schools. Being originally issued for instruction purposes it has been amended and revised with assistance from several well-known U.S. experts in radio-telegraphy. Good and useful information will therefore be looked for in the book, and in this the reader will not be disappointed. There is, however, a tendency to stretch the applications of wave meter methods beyond their legitimate scope in some instances, while in a few others there is a lack of explanatory matter. One instance of the former occurs on page 44, where it is proposed to measure the resistance of the spark gap in a transmitter on the assumption that the decrement of the circuit is the sum of the decrements due to the calculable high frequency resistance of the inductance spiral and the spark gap resistance. Such an assumption not only omits the condenser losses but also fails to take account of the losses occurring in various parts of the oscillating electromagnetic field about and around the transmitter, whereby $I^2 R$ losses are produced by induced currents in neighbouring conductors and dielectric losses in any imperfect insulators in which an alternating electric stress may be created. Lack

of explanatory matter in regard to the adjustment of a sending station to make it comply with U.S. laws is evidenced on pages 46 and 47. In the first place it is not clear why the hot-wire ammeter in the antenna circuit should indicate the "radiation" from the antenna. In the second place it is not made clear why the wave length which gives the largest reading on this instrument may be assumed to give the most powerful radiation, especially in view of the fact that an excessive inductance in the antenna will enhance the antenna resonance and will also reduce the radiation.

In view of legislation in the United States on the subject of transmitter decrements, wave meter determinations of this quantity assume an importance which they would not otherwise possess; the matter is therefore dealt with in some detail in the work under review. In this connection an expression of opinion on such legislation may not be out of place. As in this country, there appears to be in the United States also, too great a tendency to legislate first and put the assumptions made to proof afterwards. The object of the legislation is to minimise interference, and for some ill-defined reason an altogether undue proportion of interference troubles have been ascribed to large transmitter decrements. The assumption is made that a transmitter will affect a distant receiver in the same manner as it affects a wave meter in close proximity. This can be readily proved to be quite unsound. Moreover, the methods of measuring decrements are not by any means above suspicion in regard to the degree of accuracy at present attainable. For instance, among several other criticisms which might be made of such methods as are described in this book, not only do the inconsistencies of most spark transmitters coupled with slowness of response in the quantitative wave meter appliances used, render an unwholesome amount of "averaging" necessary, but quite different results are obtained from the two main slopes of a resonance curve. For the latter reason the author recommends striking a further average between these two results. The truth of the matter is that the methods of measurement are not yet sufficiently developed to justify their use in reference to legislation.

Descriptions of several forms of wave meter and kindred appliances are given, but a number of those in common use in this country are not included. The work covers 67 pages and index with 42 illustrations.

J. E. T.

Elementary Magnetism and Electricity. By Cyril M. Jansky, B.S., B.A. London: Hill Publishing Co., Ltd. Price 6/3 net.

This is a further volume of the Industrial Education series prepared in the Extension Division of the University of Wisconsin. It has been prepared for use in correspondence instruction, and is intended for individual or home study, consequently we should expect to find it free from the grosser slips and inaccuracies to which text-books of all kinds are subject, since such mistakes are certainly more excusable, or at any rate are more easily rectified, when a book is to be used by a class-student under the guidance of a teacher than when it is intended to be used without a teacher.

However, the "Recapitulation" of Chapter 1 contains the following: "*Like* poles *attract* and *unlike* poles *repel*," and on page 121 we have the statement: "The coulomb is the unit quantity of electricity and is the quantity of electricity given by one ampere in one *hour*." To pass from these glaring errors we are at once struck by a multitude of inconsistencies, of which the following are typical: Page 20, par. 2—"Magnetism is the name of an *assumed substance* producing attraction or repulsion between pieces of iron by action at a distance"; page 20, par. 3—"Magnets are bodies possessing the *property* of magnetism." Magnetism is therefore both a substance and a property—subtle but unconvincing. Magnetic Induction is defined as a "process," while Electro-Magnetic Induction is a "principle." In paragraph 9, on page 20, we read that the "strength of a magnetic field is usually represented graphically by the number of lines per square centimeter in a plane at right angles to the field"; in paragraph 7, on the same page, a magnetic field is defined as the "region or space which is permeated by a magnetic influence"—we are left to imagine the state of mind of an unaided student who attempts to construct *a plane at right angles to a region of space.* Of course the author's meaning may be clear to the reviewer, but to the student who is receiving his first lessons on magnetic fields such obscurity of definition must necessarily cause loss of time and temper.

The book contains an unusually good collection of worked examples, but even here exception must be taken to the example on power on page 197. "Niagara Falls are about 160 feet high. It is estimated that 700,000 tons of water pass over them every minute. If all the energy of this water could be utilised what horse-power could be developed?" Answer: 6,787,878 H.P. We have ourselves worked this problem (with 2,000 lb. to 1 ton) and obtain the result 6,787,878.$\dot{7}\dot{8}$ H.P.! Perhaps it did not strike the author that if his approximate height of Niagara was only one inch in error his calculated H.P. would be just over 3,000 out.

The inclusion of pretty pictures of Wireless Stations and Westinghouse Electric Locomotives does not atone for the numerous errors and still more numerous inconsistencies contained in this book. The illustrations and arrangement are good, but a careful revision of the whole book is necessary before it can be recommended to students.

P.H.S.K.

Le Théorie du Rayonnement et les Quanta. Paris: Gauthier Villars. Price 15 fr.

In the autumn of 1911 a conference was held at Brussels, under the auspices of M. Solvay, to consider and discuss certain controversial problems on physics and radiation, in the light of modern research. The gist of what took place is contained in a volume of 456 pages, bound in paper covers, and printed in French. The representative character of the assembly may be gathered from the names of some of the participants—Lorentz, Nernst, Planck, Rubens, Sommerfeld, Wein, Warburg, Jeans, Rutherford, Brillouin, Curie, Langevin, Perrin, Poincaré, Einstein, Hasenöhrl, Onnes, and Knudsen. To the physicist the contents of the volume will be found to be of much interest.

PRESSURE-REDUCING MOTOR-GENERATOR FOR HIGH-PRESSURE DIRECT CURRENT.

In the pressure-reducing motor-generator devised by P. Amsler in 1912 for use in train lighting on high-pressure systems, a distinct direct-coupled motor and generator were used, the circuits being as in fig. 1. The high-pressure machine was separately excited from the secondary low-voltage circuit, shunt characteristics being secured in the high-pressure motor while obviating connection of its field windings to the high-pressure circuit. Three 1,200/115-v. converters of this type were installed by Messrs. Brown Boveri for train lighting on the Biasca-Acquarossa line (Tessin), and similar sets have been in use for two years on the 1,500/1,800-v. Weydelstein railway (Bavaria). A number of sets, also used exclusively for lighting, are in use on the Tavannes-Noirmont railway (Switzerland). The operation of the first sets to be installed was so satisfactory that Messrs. Brown Boveri have adopted Amsler motor generators as standard on all their D.C. railway systems (using 1,200 volts or higher pressure), and use the low-pressure secondary current not only for lighting, but also for heating and for fan and air pump motors, etc. High-pressure

circuits and apparatus are thus limited in number and extent, and reliability of working is enhanced.

In order to save space and weight, Amsler motor-generators are now built within a common cylindrical yoke-housing carrying a ball-bearing at each end and arranged specially to ensure efficient cooling. A 2-KW. set constructed on the new system weighs 30 per cent. less than a 1.25-KW. set of the original type; its housing being only 370 mm. in diameter and 770 mm. in length, such a machine can be accommodated easily beneath even small rolling stock.

The new type of machine (described and illustrated in *Elek. Zeitschrift*), is built for continuous outputs of 2, 5, 10, 18, 28 or 40 KW., primary pressure 1,500 to 2,500 volts, secondary pressure 30 to 330 volts, according to size of machine. The

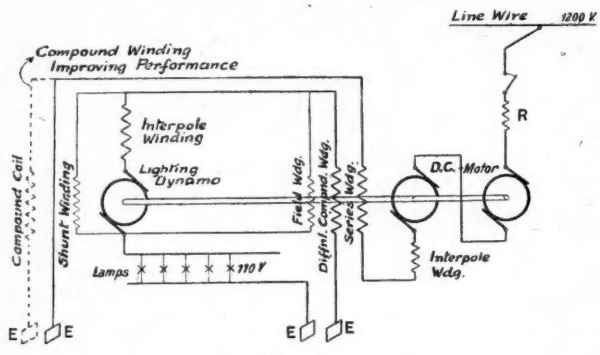


FIG. 1.

4-pole 40-KW. machine weighs 3,410 lb. and is designed for 1,000 r.p.m., but can be run considerably faster with corresponding increase in output. All motor coaches on the Chur-Arosa and Nyon-Morez railways (2,000-2,200 volts, line pressure) are equipped with these pressure transformers.

The ratio of pressure conversion is independent of variations in line pressure, and the latter are proportionately reproduced in the secondary pressure. An automatic Brown Boveri speed regulator may be used to hold the secondary pressure quite constant, the connection of the group being then as in fig. 2. All new locomotives on the Berner Oberland railway are being equipped on this system. The units actually installed comprise H.T. motor, fan and L.T. dynamo. Between 1,300 and 1,700 volts line pressure, the speed of the set and hence the fan delivery and dynamo voltage are held constant by the automatic regulator. The latter controls the dynamo excitation, and the differential compound winding of the motor is omitted since its function is performed by the voltage regulator; otherwise operation is as in fig. 1. All shunt windings are excited from the low-pressure side; the interpole and main series windings (carrying primary current) are connected to the earthed side of the armature. The armature winding alone requires high-tension insulation and is protected by mica preparation tested to 9,000 v. A.C.

Any desired fraction of the motor output may be utilised mechanically, but a fan is not required to limit the maximum speed of the motor, since the latter has shunt characteristics. In this respect the Amsler system is distinguished from cer-

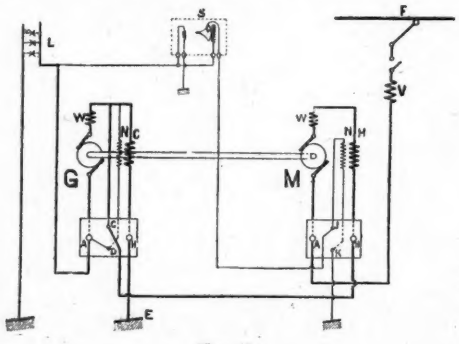


FIG. 2.

tain American systems which either (1) use a H.T. series motor with a relatively powerful fan dissipating sufficient energy to maintain practically constant dynamo pressure at all outputs; or (2) excite the H.T. motor by a small secondary battery. There is seldom useful application for the large fan required by the former alternative, and the disadvantages of an auxiliary storage battery are well known.

The Amsler sets give no excessive sparking either at the moment of connection to the H.T. line or during normal working (a 40-KW. 2,200-V. set was tested up to 3,500 V. with 20 per cent. current overload, giving satisfactory commutation throughout). Acceleration is very rapid, the starting current rising momentarily to 6 or 7 times normal; it is immaterial whether the dynamo be loaded or light during starting. To obviate current surges, a permanent series resistance R. (fig. 1) may be used with small sets; this resistance is short-circuited automatically by a dynamo-pressure relay to save losses in larger sets.

Similar motor-generator sets may be used advantageously to supply traction motors without series resistance. Further information relating to their application in this connection will shortly be forthcoming.

MAMMOTH BOILER RESULTS AND PROJECTS AT DETROIT.

THERE are now nine 2,365 H.P. Stirling boilers installed in the Delray station of the Detroit Edison Co., and experience in their operation shows that they are as reliable as turbo-generators. There are three sources from which trouble may be expected—the boiler proper, the furnace brickwork, and the stoker. If properly supervised, the boiler need introduce no shut-down hazard. From October, 1912, to November, 1913, there were but two tubes replaced in seven boilers whose average age was two years. The front tubes are worked exceedingly hard, and it is proposed to use distilled water for make-up, since even 1-16 in. scale may cause trouble. The heat required to distill water would be recovered by using the main turbine condensate for cooling the stills, hence the cost of distillation would be negligible. Furnace brickwork is limited to four furnace walls using underfeed stokers. The fallibility of the stokers is not great; ordinary repairs include replacement of burnt tuyeres and dump plates, etc. One-side firing (and half boiler ouptput) is practicable temporarily in case of serious burn-out. In the Delray station, the boilers have been ready for service 95 per cent. of the time considered, 98 per cent. of the five full-load days of each week, and 100 per cent. of the peak-load periods (4 to 6 p.m.). At no time has it been compulsory to put a boiler out of commission. The boilers are down for ten or fourteen days at nine or ten months' intervals for cleaning and general overhaul.

The Detroit Edison Co. is now building a power plant to contain six 20,000 KW. turbines served by twelve boilers, *i.e.*, 10,000 KW. per boiler with no spares. Though experience shows the chances of forced boiler shut-down to be remote, the contingency has been considered. At normal full load, the two boilers supplying a given turbine unit will operate at approximately 191 per cent. of builders' rating (on 10 sq. ft. heating surface per boiler H.P.). If one of six boilers working at this rating should fail, the other five would operate at 235 per cent. rating and maintain full output. The settings and auxiliaries are being designed to permit continuous operation at 255 per cent. rating (*i.e.*, three boilers taking the full load of four).

The overall boiler and furnace efficiency of a Taylor stoker-fired unit at Delray varies from 81 per cent. at 90 per cent. rating (equivalent evaporation 3.1 lb. from and at 212° per sq. ft. heating surface per hour) to 77.5 per cent. at 215 per cent. rating (equivalent evaporation 7.45 lb.), hence as many boilers as possible are run at 90 per cent. rating during light-load periods and peak-load is carried by increasing the boiler rating. This flexibility is particularly valuable in tiding over sudden thunderstorm peak-loads. The average day load at Delray will be 63,000 KW. this summer, and the boilers then operating at 100-125 per cent. rating will take 30 per cent. increase in load with little effort.

The policy adopted has been to reduce the stoking staff to a minimum, increasing the responsibility of each man and employing only first-class firemen. A gauge board and control point are provided for each boiler. A water tender (man) on a gallery at the top drum level looks after the boiler feed, but otherwise the fireman is entirely responsible. Each man operates two stokers and a head fireman is in charge of six or eight units. Eight-hour shifts are worked, and ordinary and head firemen are paid 1s. 8d. to 1s. 10½d. per hour respectively. The cost of firing averages only 0.0038d. per KW.-hr. Boiler dampers are shifted at the control point; the throttles of the blower turbines are extended through the floor and 18-point controllers are provided for the stoker motors. The latter are d.c. interpole machines with 4 : 1 speed regulation; the power required by the stokers is very variable and it is difficult to make an engine govern satisfactorily with so wide a controlled speed range. On the gauge boards are pressure gauges connected to the superheater inlet and outlet; gauges showing the draught under the fire, at the damper and at the top of the combustion chamber; and CO_2 meters. The fireman is guided primarily by steam requirements as shown by a pilot steam gauge and a steam flow meter. Furnace conditions are judged by the CO_2 recorder, the air pressure required for a given boiler load and the colour of the gases as they tumble over the first baffle. Air pressure and stoker speed are hand controlled and the company's prejudice (says Mr. J. W. Parker before the American Society of Mechanical Engineers) is against automatic control. Circulation in these boilers is so rapid that the water level in the top middle drum often stands two feet or move above that in the outside drums; this makes automatic regulation of feed unsatisfactory on variable load.

Best results are believed to be secured by encouraging intelligent interest on the part of the firemen. At Delray, an average of 13.5 to 14 per cent. CO_2 and 0 to 0.2 per cent. CO is found in the flue gases. Periodic dumping from the stokers often disburbs good conditions, and a revolving grate continuous dumping device is being tried with good results.

Allowing for overhauling at interyals of eight months, it is estimated that the average cost of maintenance (including stokers, settings and boilers) is 0.0017d. per KW.-hr.—the plant capacity being 120,000 KW. and the annual load factor 36 per cent. In the last two units installed at Delray, the setting walls are built slightly concave on the fire side. It is hoped that this vertical arch construction will prevent bulging in of the brickwork.

As at present built, the Delray boilers are limited to about 275 per cent. rating, since unburnt gases then commence to get into the superheater pass (though the combustion chamber is 28ft. in height), and though secondary combustion occurs, the overall efficiency decreases. Another limitation is the drop in pressure through the superheater, the automatic check valves and boiler stop valve. At 210 per cent. rating, the drop in the superheater and check valves is 21 lb., and at 255 per cent. rating it is considerably greater.

GERMAN EXPORTS FOR THE HALF-YEAR.

The following table shows the exports of electrical goods from Germany during the half-year just closed; figures for the first half-year of 1913 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1913. Kilogs.	1914. Kilogs.	Inc. or dec. Kilogs.
Dynamos, electric motors, transformers, &c., weighing up to 25 kg.—			
To Great Britain	31,000	39,000	+ 8,000
„ Austria	57,000	63,000	+ 6,000
„ Russia	99,000	87,000	— 12,000
„ Other countries	187,000	191,000	+ 4,000
Total	374,000	380,000	+ 6,000
Ditto, weighing from 25 kg. to 100 kg.—			
To Belgium	88,000	114,000	+ 26,000
„ France	100,000	128,000	+ 28,000
„ Great Britain	147,000	109,000	— 38,000
„ Holland	112,000	95,000	— 17,000
„ Austria	266,000	218,000	— 48,000
„ Russia	217,000	353,000	+ 136,000
„ Spain	97,000	88,000	— 9,000
„ Other countries	460,000	447,000	— 13,000
Total	1,487,000	1,552,000	+ 65,000
Ditto, weighing from 100 kg. to 500 kg.—			
To Belgium	310,000	280,000	— 30,000
„ France	156,000	148,000	— 8,000
„ Great Britain	357,000	440,000	+ 83,000
„ Italy	194,000	158,000	— 36,000
„ Holland	251,000	260,000	+ 9,000
„ Austria	279,000	236,000	— 43,000
„ Russia	391,000	651,000	+ 260,000
„ Spain	274,000	173,000	— 101,000
„ Brazil	286,000	177,000	— 109,000
„ Argentina	189,000	203,000	+ 14,000
„ Other countries	996,000	1,073,000	+ 77,000
Total	3,683,000	3,799,000	+ 116,000
Ditto, weighing over 500 kg.—			
To Belgium	1,133,000	652,000	— 481,000
„ France	542,000	397,000	— 145,000
„ Great Britain	640,000	1,348,000	+ 708,000
„ Italy	863,000	2,103,000	+1,240,000
„ Spain	1,270,000	667,000	— 196,000
„ British South Africa	625,000	514,000	— 111,000
„ Japan	1,204,000	1,042,000	— 162,000
„ Argentina	831,000	580,000	— 251,000
„ Brazil	610,000	377,000	— 233,000
„ Norway	412,000	476,000	+ 64,000
„ Russia	832,000	1,381,000	+ 549,000
„ Holland	530,000	619,000	+ 89,000
„ Other countries	2,737,000	3,103,000	+ 366,000
Total	12,229,000	13,259,000	+1,030,000
Arc lamps.—			
To Great Britain	33,000	20,000	— 13,000
„ Russia	68,000	38,000	— 30,000
„ Argentina	46,000	22,000	— 24,000
„ Austria	27,000	9,000	— 18,000
„ Other countries	122,000	64,000	— 58,000
Total	296,000	153,000	— 143,000
Accumulators.—			
To Denmark	171,000	524,000	+ 353,000
„ Holland	381,000	309,000	— 72,000
„ Sweden	503,000	254,000	— 249,000
„ Japan	201,000	28,000	— 173,000
„ Argentina	537,000	852,000	+ 315,000
„ Chile	371,000	436,000	+ 65,000
„ Other countries	1,030,000	813,000	— 217,000
Total	3,194,000	3,216,000	+ 22,000
Cable.—			
To Belgium	1,520,000	4,236,000	+2,716,000
„ Holland	2,650,000	4,334,000	+1,684,000
„ Norway	1,871,000	1,217,000	— 654,000
„ Sweden	744,000	1,101,000	+ 357,000
„ British South Africa	1,008,000	368,000	— 640,000
„ Japan	2,024,000	290,000	—1,734,000
„ Argentina	4,134,000	3,936,000	— 198,000
„ Chile	386,000	601,000	+ 215,000
„ Other countries	6,894,000	4,486,000	—2,408,000
Total	21,231,000	20,569,000	— 662,000
Metal-filament lamps.—			
To Great Britain	69,000	54,000	— 15,000
„ Austria	84,000	91,000	+ 7,000
„ Russia	98,000	159,000	+ 61,000
„ Italy	69,000	95,000	+ 26,000
„ Spain	48,000	34,000	— 14,000
„ Argentina	54,000	32,000	— 22,000
„ Brazil	43,000	28,000	— 15,000
„ France	59,000	46,000	— 13,000
„ Japan	21,000	70,000	+ 49,000
„ Other countries	381,000	337,000	— 44,000
Total	905,000	946,000	+ 41,000
Telephone appliances.—			
To Great Britain	62,000	53,000	— 9,000
„ France	31,000	26,000	— 5,000
„ Russia	60,000	58,000	— 2,000
„ Italy	50,000	56,000	+ 6,000
„ Other countries	224,000	249,000	+ 25,000
Total	427,000	442,000	+ 15,000
Electric light, power, &c., appliances.—			
To Belgium	627,000	1,059,000	+ 432,000
„ Great Britain	481,000	996,000	+ 515,000
„ Austria	912,000	1,176,000	+ 264,000
„ Russia	1,118,000	2,207,000	+1,089,000
„ Spain	584,000	315,000	— 269,000
„ British South Africa	179,000	181,000	+ 2,000
„ Japan	204,000	230,000	+ 26,000
„ Argentina	697,000	843,000	+ 146,000
„ Brazil	382,000	233,000	— 149,000
„ Chile	242,000	700,000	+ 458,000
„ Italy	661,000	791,000	+ 130,000
„ Switzerland	408,000	404,000	— 4,000
„ Other countries	2,503,000	4,893,000	+2,390,000
Total	8,998,000	14,028,000	+5,030,000
Electric meters.—			
To Great Britain	143,000	117,000	— 26,000
„ Italy	168,000	231,000	+ 63,000
„ Austria	191,000	230,000	+ 39,000
„ Russia	242,000	309,000	+ 67,000
„ Spain	119,000	117,000	— 2,000
„ Argentina	130,000	77,000	— 53,000
„ Other countries	516,000	726,000	+ 210,000
Total	1,509,000	1,807,000	+ 298,000
Batteries.—			
To Great Britain	162,000	220,000	+ 58,000
„ Holland	51,000	75,000	+ 24,000
„ Russia	50,000	34,000	— 16,000
„ Sweden	40,000	72,000	+ 32,000
„ Switzerland	46,000	71,000	+ 25,000
„ Other countries	263,000	349,000	+ 86,000
Total	612,000	821,000	+ 209,000
Finished armatures and commutators.—			
To Belgium	104,000	148,000	+ 44,000
„ Great Britain	200,000	254,000	+ 54,000
„ Italy	201,000	138,000	— 63,000
„ Austria	281,000	175,000	— 106,000
„ Russia	232,000	545,000	+ 313,000
„ Japan	202,000	131,000	— 71,000
„ Argentina	100,000	122,000	+ 22,000
„ Other countries	890,000	908,000	+ 18,000
Total	2,210,000	2,421,000	+ 211,000

	1913. Kilogs.	1914. Kilogs.	Inc. or dec. Kilogs.
Insulating tubes of paper.—			
To Belgium	165,000	163,000	— 2,000
,, Russia	192,000	119,000	— 73,000
,, Sweden	200,000	168,000	— 32,000
,, Switzerland	419,000	63,000	— 356,000
,, Italy	168,000	84,000	— 84,000
,, Other countries ...	704,000	699,000	— 5,000
Total ...	1,848,000	1,296,000	— 552,000
Electric signalling apparatus.—			
Total ...	499,000	592,000	+ 93,000
Wireless telegraphy apparatus.—			
Total ...	125,000	206,000	+ 81,000
Electric medical and dental appliances.—			
Total ...	257,000	421,000	+ 164,000
Heating and cooking apparatus.—			
Total ...	146,000	191,000	+ 45,000

Kilog = 2.204 lb.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Ccmpiled expressly for this Journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,258. "Rotary field magnets." W. P. Thompson. August 7th. (Aktiebolaget Ljungströms Angturbin, Sweden). (Complete).

18,261. "Motor starting rheostat." G. M. Johns. August 7th. (Complete).

18,276. "Electric fuses or cut-outs." A. H. Railing & A. J. D. Krause. August 7th.

18,277. "Means for connecting electrical conduits to their fittings." A. Myers and L. Myers. August 7th.

18,280. "Apparatus for detecting the presence of fire-damp and other gases in connection with the use of the electric lamp or battery." W. Gaudie and G. Wilkinson. August 7th.

18,281. "Ventilation of alternating-current dynamo-electric machines." G. A. Juhlin. August 7th.

18,286. "Multiple electric needle-holder for epilation purposes." C. Blakeney (trading as Catherine Stanley Blake). August 7th.

18,290. "Writing or copying telegraph system." A. G. Bloxam. August 7th. (Telepantograph-Ges.m.b.H., Germany). (Complete).

18,302. "Electric hoisting-apparatus." A. H. Colley. August 7th.

18,317. "Lighting electric lamps." F. Westwood. August 7th.

18,353. "Starters for electric motors." Siemens Bros. Dynamo Works, Ltd., & E. Schupp. August 7th. (Addition to 5,514/14). (Complete).

18,368. "Electric relays." British Thomson-Houston Co., Ltd. August 7th. (General Electric Co., United States).

18,369. "Incandescent electric lamps." Allgemeine Elektricitats-Ges. August 7th. (Convention date, August 1st, 1913, Germany). (Complete).

18,380. "Electric power." H. L Todd, R. Wellesley, and H. F. Pattinson. August 7th.

18,396. "Cooling-arrangements for dynamo-electric machinery." Siemens Bros. Dynamo Works, Ltd., & E. O. Kieffer. August 7th.

18,397. "Percussion tools." Siemens-Schuckertwerke G.m.b.H. August 7th. (Convention date, August 8th, 1913, Germany). (Complete).

18,408. "Radio-dynamic control of gyroscopes." J. H. Hammond, junr. August 7th. (Convention date, August 14th, 1913, United States). (Complete).

18,418. "Electric sign flashers." L. J. Schrubb. August 7th. (Complete).

18,435. "Electrically-propelled drill." H. A. Whiteside. August 7th.

18,440. "Mechanical apparatus for retarding the tripping-mechanism of automatic electrical circuit brakes." G. F. J. Dandridge. August 8th.

18,442. "Electro-magnetic unlocking and unscrewing apparatus for miners' lamps." O. Oldham. August 8th.

18,464. "Prepayment electricity meters." Landis & Gyr, Ltd. August 8th. (Convention date, August 9th, 1913, Switzerland). (Complete).

18,465. "Excess voltage devices for protecting electrical circuits." Siemens-Schuckertwerke G.m.b.H. August 8th. (Convention date, August 21st, 1913, Germany). (Complete).

18,466. "Control of searchlights, guns, or the like from a distance and means therefor." Siemens Bros. Dynamo Works, Ltd. August 8th. (Siemens-Schuckertwerke G.m.b.H., Germany). (Complete).

18,476. "Manufacture of tungsten filaments for electric incandescent lamps." E. R. Grote. August 8th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

9,103. Railway Safe-running Devices. A. R. Angus. April 17th. (April 17th, 1912.)

13,976. Electric Signalling Systems, suitable for Party Line Telephone and like systems. Automatic Telephone Manufacturing Co. and H. H. Harrison (partly Automatic Electric Co.). June 17th.

14,218. Transmitters for Submarine Sound Signals. Signal Ges. June 19th. (June 24th, 1912.)

14,498. Method of and Means for Detecting Dangerous Atmospheres in Mines and for Operating an Alarm therein. G. Schauli. June 23rd. (January 23rd, 1914.)

16,696. Telephone Machine Switching Systems. Western Electric Co. (F. T. Woodward acting for Western Electric Co.) July 21st.

16,725. Device for Starting and Stopping Submarine Syrens. Signal Ges. July 21st. (July 29th, 1912.)

17,265. Electrically-illuminated Letters, Signs, and the like Devices. H. Hirst and B. H. Jenkinson. July 28th.

17,337. Signalling, Regulating and Controlling Street Traffic, and the method of its application for such Traffic. T. W. S. Firth and J. N. C. Kennedy. July 28th.

17,688. Electric Cooking-apparatus. M. J. Railing and G. Maurice. August 1st.

18,412. Regulation of Variable-speed Dynamo-electric Machines. A. H. Midgley and C. A. Vandervell. August 13th.

19,205. Method of Electrically Operating Railway Signals. R. Meakin. August 25th.

19,209. Illumination of Chart Tables. E. P. Fletcher. August 25th.

19,803. Heating Water by Electricity. H. Trenferry and A. Kingman. September 2nd.

20,654. Galvanometers or the like. Cambridge Scientific Instrument Co., and W. H. Apthorpe. September 12th.

22,503. Switches for Electric Self-starting Devices and Lighting Circuits for Motor Vehicles. T. W. Tattersall & J. W. Tattersall. October 6th.

23,715. Elements for Electric Heating Devices or Radiators. R. A. S. Paget. October 20th.

24,327. Apparatus for Magnetizing Permanent Magnets. S. C. Newton. October 27th.

24,565. Electric Heating Element. S. E. Foster. October 29th.

24,928. Switching Apparatus for Telephone Exchange Systems. Western Electric Co. November 1st. (F. I. Woodward, acting for Western Electric Co.)

25,129. Electrically-operated System of and Apparatus for Automatic Signalling on Railways. E. W. Bottle. November 4th.

25,659. Telephone Repeaters. Western Electric Co. November 10th. (F. T. Woodward, acting for Western Electric Co.).

26,734. Method of and Apparatus for Controlling Guns or other Mechanisms from a Distance. E. Schneider. November 20th.

27,050. Electrical Processes for Rivetting and Apparatus therefor. Siemens & Halske Akt.-Ges. November 24th. (November 22nd, 1912).

27,163. Retrievers for Trolley Collectors on Electric Traction Systems. F. A. Wasson. November 25th. (May 12th, 1913).

27,424. "In and Out" Indicators and the like. A. G. V. Elder. November 28th.

27,669. Metallic Bodies Adapted for Sealing into Glass and the like. B. E. Eldred. December 1st.

27,771. Electric Glow Lamps. E. A. Kruger & K. Sannig. December 2nd.

28,633. Switching Devices for Electric Installations. Siemens Bros. Dynamo Works. December 11th. (Siemens Schuckertwerke Ges.).

29,096. Automatic Signal-register to Automatically Indicate Colliery and other Signals to Colliery Enginemen and others and also to Automatically Release Signals when complied with. W. Littlewood. December 17th.

1914.

196. Electrical Coupling Devices for Railway and other Vehicles. L. Boirault. January 3rd. (Divided Application on 21,480/13. September 23rd).

3,900. Mounting Bracket for Electric-switches and the like. A. Heckt. February 14th. (February 14th, 1913).

4,583. Metallic Conduits for Electric Conductors. C. F. Burton, Slater H. Burton, & C. F. Burton. February 23rd.

6,037. Electric Filament Lamps. E. Vass, L. Máteh, & F. Burger. March 10th.

7,482. Electric Ignition Lighting and Starting Systems for use with Internal-combustion Engines on Motor Vehicles. R. Varley. March 24th. (Divided Application on 8,679/13. April 12th).

7,686. Connecting Devices for the Leads from Portable Secondary Batteries. Robert Bosch (Firm of). (June 7th, 1913). March 26th.

9,970. Retrievers for Trolley Collectors on Electric Traction Systems. F. A. Wasson. April 22nd. (May 12th, 1913. Divided Application on 27,163/13. November 25th).

12,483. Circuit Arrangements for Automatic or Semi-automatic Telephone Installations. Siemens & Halske Akt.-Ges. May 20th. (May 20th, 1913. Addition to 16,538/13).

13,883. Railway Safe-running Devices. A. R. Angus. June 8th. (February 13th, 1913. Divided Application on 9,090/13. April 17th).

13,884. Railway Safe-running Devices. A. R. Angus. June 8th. (February 13th, 1913. Divided Application on 9,090/13. April 17th).

13,916. Railway Safe-running Devices. A. R. Angus. June 9th. (February 13th, 1913. Divided Application on 9,103/13. April 17th).

14,189. Railway Safe-running Devices. A. R. Angus. June 12th. (February 13th, 1913. Divided Application on 9,090/13. April 17th).

German Exports of Electrical Products, 1914.—H.M. Vice-Consul at Leipzig (Mr. R. M. Turner) reports that the value of the exports of German electrotechnical products during the first six months of this year was 146,230,000 marks, as compared with 127,770,000 marks in the first half of 1913. During this period 20,569 metric tons of electric cable, officially valued at 16,900,000 marks, were exported, as compared with 21,231 metric tons, valued at 18,260,000 marks, in the first half of 1913. It is probable that the real diminution in value was somewhat larger, as the orders were in many cases only obtained by granting considerable price concessions. The exports of submarine cables ceased almost entirely, dropping from 2,261 metric tons to 44 metric tons. The exports of dynamos during the first six months of this year amounted to 18,991 metric tons, valued at 29,170.000 marks, as compared with 17,773 metric tons, valued at 26,430,000 marks, in the corresponding period of last year. The increase was particularly noticeable in dynamos weighing over half a ton. Electrical appliances for lighting and power transmission were exported to the value of 42,570,000 marks during the first half of this year, as compared with 25,230,000 marks during the corresponding period of 1913. The exports to Belgium, Austro-Hungary and Russia were particularly large. The exports of metal-filament lamps were also considerably larger in quantity, but the value was lower on account of severe price-cutting; 20,900,000 lamps, valued at 19,220,000 marks, were exported during the period under review, as compared with 19,500,000 lamps, valued at 19,600,000 marks, in the corresponding period of 1913. Mark = 11·8d.—*B. of T. Journal.*